

Considerations in Traumatic Arrest



**Art Proust,
MD, FACEP**

In lieu of the article "Can You Make the Diagnosis" contributed for many years by Art Proust, MD, FACEP, ITLS Illinois Chapter Medical Director, the following article "Considerations

in Traumatic Arrest" written by Evan Darger BA, NRP, is being shared.

"You are training with your crews when the tones alert for an accident with injuries, vehicle vs pedestrian, at an intersection near your station. You respond, accompanied by an engine, and soon arrive on the scene. You find a young adult male, unresponsive, on the ground in front of a sedan in the roadway. The driver of the sedan is out of the car, kneeling by the side of the patient on the ground. As you approach he says that he did not see the patient as he stepped out in front of the vehicle and he struck him going approximately 35 miles per hour. The driver states that the patient was thrown onto the hood of the care before falling to the street. Your assessment finds the pa-

tient unresponsive, with a Glasgow Coma score of 3, weak and rapid carotid pulses and agonal, shallow respirations. Physical exam reveals a flail chest and unstable pelvis, along with multiple abrasions with no significant external blood loss noted. As you are continuing your assessment, you note the patient stops breathing and a quick check reveals that they have lost pulses as well."

How would you approach this patient? What are some of the considerations in the management of cardiac arrest when the origin is presumed to be traumatic in nature? This training is intended to reinforce your understanding of one of the highest acuity patient presentations you will encounter, how the management of traumatic arrest differs from that of medical arrests, and what tools you have at your disposal to address the most common reversible causes of arrest in trauma. Part one of this training will be focused towards all levels of providers (EMT and Paramedics) while part II will be directed towards Paramedics.

(Part I) Etiology of arrest and basics of trauma arrest management

Often the etiology of out of hospital cardiac arrest (OHCA) is medical in nature. This can bias providers towards providing care to Traumatic Cardiac Arrests (TCA) as though they were treating a medical arrest. There are important differences in the pathology of the arrest to be aware of which change our treatment. Evidence tells us that there is a statistically significant difference in the survival for OHCA which is medical in nature when aggressive resuscitation efforts

are applied on scene as opposed to TCA. This training will go into the background of the most common preventable causes of death in TCA with the goal of shifting providers frame of reference when encountering TCA.

The leading preventable causes of death in trauma are as follows: **hemorrhage amendable to a tourniquet or pressure, airway obstruction, and tension pneumothorax.**

1) **Hemorrhage amendable to a tourniquet or pressure:** The amount of blood in the human body differs depending on size and sex, but a rough estimate is that average size adults have between 4.5 to 5.5 liters of blood. A healthy adult can tolerate blood loss of up to roughly 30% of total volume (up to 1.5 liters) before their perfusion begins to be directly affected. With regards to shock, your body has compensatory mechanisms that will be put to work to ensure systemic perfusion remains unaffected. Signs of compensatory shock are signs that the sympathetic nervous system is activated (increased pulse, respiratory rate, paling of the skin, though tellingly the systolic pressure may often remain the same or even decrease slightly). An early sign of hemorrhagic shock often overlooked will be a narrowing of the pulse pressure (the difference between the systolic and diastolic pressures). If more blood is lost the body can compensate for, you will begin to see signs of decompensation, which include delayed capillary refill and altered mental status. Therefore, early identification and hemorrhage control is a critical skill of first **Continued on Page 2**

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responders, even if that bleeding is not external. While this may seem self-evident, a recent investigation of preventable mortality listed unidentified hemorrhage as the leading preventable causes of death in trauma in 2021 . Southern Fox Valley providers have, at the BLS level, many resources available to them for hemorrhage control including Hemostatic agents (QuickClot), tourniquets and pressure dressings.

2) **Airway management:** Loss of muscular tone secondary to traumatic brain injury is one of the leading causes of airway obstruction in trauma. As such, aggressive airway management in trauma plays an important role in the management of a trauma patient. With that said, Chris Nickson from the popular medical blog "Life in the Fast Lane" frames it as such, that it may help to shift our thinking from simply "aggressive airway management" to "aggressive airway management with cervical spine stabilization" as up to 10% of patients with a traumatic brain injury will have a concomitant cervical spinal cord injury . While patients who have suffered penetrating trauma rarely need SMR unless there is indication of spinal cord injury, all patients who suffered blunt traumatic cardiac arrest must have spinal motion restriction precautions taken throughout their care, unless the safety of patient or crews does not allow for it. It is important to remember that with airway management in trauma, "advanced does not necessarily mean better". There is conflicting evidence on whether advanced airway management improves or worsens patient outcomes, but what is clear is that prolonging scene time to secure an airway is associated with worsening patient outcomes. Instead, the provider must think about airway management in terms of ensuring adequate oxygen delivery, which can be done with basic maneuvers such as jaw-thrust, temporizing bag valve mask ventilations, and airway adjuncts or supraglottic airways.

3) **Tension pneumothorax:** Even at a BLS level, the identification of tension pneumothorax is an important assessment skill as it is one of the leading preventable causes of death in trauma. When the visceral pleura of the lungs is compromised, air leaking into the pleural space increases the intrathoracic pressure, which can put pressure on the vena cava (the venous return to the heart) which can, in turn, decrease cardiac output. Tracheal deviation can be a very late sign, so providers should instead have a low threshold for suspicion of tension pneumothorax in traumatic arrest. Unilateral (or bilateral for that matter) absence of lung sounds with mechanical ventilations should be enough to trigger providers to suspect a pneumothorax. Even BLS providers need to be aware of the pathology of, and have the skill set to identify tension pneumothoraces to expedite ALS care or transport to the closest trauma center.

Like medical causes of arrest, each of these preventable causes of death in trauma has a treatment that EMS can initiate. In medical arrests, with few differences, the same ACLS guidelines that are followed in the prehospital setting are followed during in hospital cardiac arrests. In traumatic arrest, each of the above preventable causes of death can, in some cases, be addressed differently and more appropriately in the hospital setting. The Southern Fox Valley EMS Region is unique in the availability of Trauma Centers which make rapid transport to a trauma center feasible. For BLS providers, it is enough to understand that expediting transport after initial assessment and decision to initiate resuscitative efforts is the most appropriate course of treatment vs. the resuscitate on scene approach used in medical arrests.

A final note on fundamentals of care during TCA regarding the use of automated compression devices such piston-driven or load-distributing band systems (LUCAS or

AutoPulse): there is ongoing research into the efficacy of mechanical CPR devices for OHCA and TCA. The Southern Fox Valley EMS System currently recommends providers follow the manufacturers recommendations for each delivery model. Currently the LUCAS piston-driven MCPDR device does not list trauma as a contraindication whereas the Zoll Autopulse does. Providers are authorized to follow these manufacturer's recommendations regarding the indication and contraindications for each respective piece of equipment.

(Part II) ALS approach to traumatic arrest

For ALS personnel in the system, the approach to traumatic arrests does not differ much from BLS. This section will simply expand the breadth and depth of our understanding of the approach to traumatic arrest to a complex, comprehensive level. The fundamentals remain the fundamentals for a reason: hemorrhage control, airway management with cervical spine immobilization, and rapid transport will give your patient the best potential for a positive outcome. While it a popular belief that traumatic arrests have a poorer outcome than medical arrests, there is a growing body of evidence to suggest that aggressive resuscitative efforts of traumatic arrests yield outcomes equal to those of medical arrests . The odds of successful resuscitation depend heavily on the etiology of arrest. That said, there are additional considerations when deciding to initiate resuscitative efforts.

1) **Treatment for significant hemorrhage:** In patients who are suffering from cardiac arrest secondary to significant hemorrhage, survival is unlikely if uncorrected severe hypovolemia exists. While BLS providers can stem the blood loss by controlling the hemorrhage, this only serves to prevent further deterioration and will not improve the patient's condition. The best treatment for significant blood loss is replacement with whole blood in the hospi-

tal setting. This is one reason to expedite transport in patients in traumatic cardiac arrest. Prehospital providers should initiate aggressive fluid resuscitation in consecutive 200 mL boluses (warm fluids) with TXA (1 gram mixed with 100 mL 0.9 NS IV) if there is an index of suspicion that volume loss is significant (reference SFV Hemorrhage Control protocol for inclusion and exclusion criteria). It is important to remember that fluid resuscitation should be judicious in trauma and only given in the absence of arrest to target BP's (80 mmHg in blunt trauma and 90 mmHg in penetrating trauma). This is because aggressive fluid resuscitation can exacerbate the lethal triad of hypothermia, acidosis and coagulopathy. While not the primary focus of this training, to successfully resuscitate critical trauma patients, providers need to have a comprehensive knowledge of the lethal triad in relation to trauma.

a. **Hypothermia:** Core body temperature is a leading predictor of mortality in trauma. It is of note that hypothermia can occur at any time during the year, and outside weather conditions are not a primary predictor of core body temperature upon arrival at the ED. Alcohol consumption, traumatic brain injuries, and hemorrhage can all impede the body's ability to regulate its temperature. The body's clotting mechanism does not function appropriately in the presence of hypothermia and fluid overload, and this complicates hemorrhage control for the EMS providers. Providers must prophylactically treat for hypothermia in the critical trauma patients with warm fluids, blankets, and raising the temperature in the back of the ambulance.

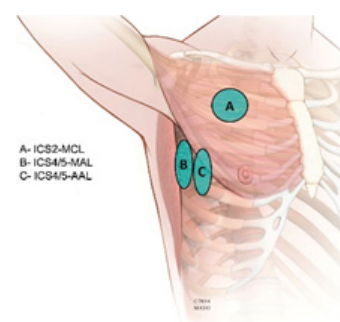
b. **Acidosis:** The body's normal pH lies between 7.35-7.45, and its ability to clot functions optimally in this range. When perfusion is affected due to blood loss, metabolic acidosis quickly sets in. This can be exacerbated by the isotonic fluid Normal Saline, which is acidotic relative to the

body. Therefore, fluid resuscitation in the prehospital setting must be judicious, as it can worsen existing acidosis.

c. **Coagulopathy:** Coagulopathy is when the body's clotting mechanism becomes dysfunctional. As already identified, this can be the result of hypothermia and acidosis. In addition to these, clotting factors and oxygen carrying capacity can become diluted with overly aggressive fluid resuscitation, thus worsening the cycle. This lethal triad is a vicious, positive feedback loop that is difficult to interrupt once it has taken hold. Therefore, providers must be aware of its components for consideration during treatment.

2) **Airway management:** Regarding airway management, we must re-emphasize that advanced does not necessarily mean better. Too often providers delay transport to secure an advanced airway where basic maneuvers may be perfectly appropriate. If providers determine that intubation is required, utilization of bougie flexible ETT introducers has been shown to improve first pass success rates. Airway management should be performed while en route to the nearest trauma center if it has not been performed as part of patient packing during a prolonged extrication. As with all airway management, the use of waveform capnography must be used both to ensure continued positive placement, but also to guard against post-intubation hypocapnia resulting from adrenaline induced over-ventilation by those who are bagging, which is shown to worsen outcomes. Additionally, waveform capnography serves to assist in monitoring the perfusion status of the patient. In the presence of maxillo-facial trauma, a low threshold for bougie assisted surgical crich is an often-overlooked procedure which would allow providers to definitively secure the airway in a cannot-intubate cannot-oxygenate situation .

3) **Tension pneumothoraxes:** The presence of a tension pneumothorax can easily be unappreciated in the traumatic arrest patients. Providers must have a low threshold for bilateral decompression. Difficulty bagging or absent lung sounds, regardless of the presence of an advanced airway in place, should trigger providers to decompress the affected side or sides. An additional advantage to the rapid transport of the traumatic arrest patient is the ability for providers in the ED setting to perform a thoracostomy if indicated. In the prehospital setting, we are limited to needle thoracostomies. It is important to ensure that adequate size catheters are available for providers to perform a needle thoracostomy successfully. The standard 1.25" 14 gauge angiocath has been found to be inadequate in most patients due to chest wall thickness at the primary landmark for pleural decompression (2nd ICS MCL), so specially designed decompression needles such as the ARS decompression needle from North American Rescue have been designed specifically to ensure adequate depth. In addition to appropriate equipment, the identification of landmarks has been identified as an issue associated with success decompression. The 2nd intercostal space, mid-clavicular line (MCL) has historically been the primary site for pleural decompression, but the 5th intercostal space, anterior/mid axillary line, has been shown to be an alternative site with a shorter distance to the pleural cavity (image below). This site comes with an additional advantage of being accessible where the patient is a member of law enforcement and wearing body armor, though providers should be aware of the increased risk of displacement while moving the patient.



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Future of Traumatic Cardiac Arrest Treatment

As with any other pathology in EMS, the treatment of traumatic arrest is subject to change to stay up-to-date with the most current evidence-backed-practice. Some changes that may be coming to treatment of TCA are as follows: no chest compressions, no use of epinephrine, and the introduction of finger thoracostomies.

1) Role of chest compressions in TCA:

Chest compressions have been a core component in the care of cardiac arrest for as long as EMS has been responding to calls. However, the studies that have reported on the benefits of chest compressions have largely looked at euvoletic patients (patients who are not hypovolemic). There is a growing body of evidence to suggest that in patients suffering from cardiac arrest secondary to hypovolemia may not benefit from external chest compressions. In fact, external chest compressions may worsen outcomes in TCA, interfering with other interventions which may be more beneficial to patients suffering from TCA. (SFVEMSS currently advocates for external chest compressions to be performed on all cardiac arrest, traumatic or otherwise.)

2) Role of Epinephrine in TCA:

Similar to external chest compressions. There is limited evidence to support the use of Epinephrine in TCA (with exceptions for neurogenic shock). Smith, et al, point out in their paper Traumatic Cardiac Arrest "There is an increased risk of mortality in adults with blunt trauma when vasopressors are used."

3) Thoracostomies:

Earlier in the education, the complications associated with needle decompression were noted (identification of landmark, size of needle, length of needle). A growing body of evidence suggests that finger thoracostomies may be preferred over needed decompression.

This procedure involves making an incision at 4th or fifth intercostal space, mid-axillary line, followed by a blunt dissection with forceps or finger through the intercostal muscles and pleural. Positive pressure ventilations allow for adequate oxygenation after the pleural space has been breached.

Summary

The Southern Fox Valley EMS System has seen a recent spike in traumatic arrests. After a period with lower than typical traumatic arrests during the reduced activity of 2020 and 2021, it is important to re-emphasize the differences in treatment for traumatic arrest vs medical arrests. With the medical arrest, ACLS resuscitative efforts are initiated and continue on scene. In contrast, with traumatic arrests, the focus should be directed to hemorrhage control and volume loss management, airway management with spinal motion restriction considerations, and a lowered threshold for initiation of pleural decompression in instances where tension pneumothorax are suspected. Additionally, providers must be aware of the mechanism behind the lethal triad (hypothermia, acidosis, and coagulopathy) and treat their patient appropriately. The following tables identifies the take-aways of this education and summarizes the reversible causes of TCA.

"You make the decision to expedite transport to the nearest trauma center, which is 12 minutes away. After rapidly binding your patients pelvis as you place him on a backboard, you place the patient on the monitor to find a rapid PEA. Your crew maintains manual CPR throughout transport while managing the airway with an lgel as there is no appreciable facial trauma and monitor the patient's perfusion via waveform capnography. You suspect hemorrhagic shock from internal hemorrhage and establish bilateral vascular access, initiating 200 mL boluses of warm fluids in one with TXA being administered per protocol. En route you perform bilateral needle decompression with no return of pulses noted. You are conscious to keep the ambulance heaters on full blast to keep the patient as warm as possible and call a Trauma alert as part of your inbound radio report. Upon arrival at the ED, a Trauma team receives the patient and initiates a massive transfusion protocol which successfully restores pulses. A bedside ultra-sound reveals massive internal hemorrhage and the patient is transferred to the operating room where more extensive internal injuries are noted. Despite the best efforts of EMS, emergency physicians and the surgical team, the patient expires on the operating table."

Evan Darger BA NRP
Southern Fox Valley EMS System Coordinator
Northwestern Medicine - Delnor Hospital

Cause	Treatment
Hypoxia	Oxygenate (airway management)
Tension Pneumothorax	Decompress chest
Cardiac Tamponade	Decompress Tamponade (ED intervention)
Hypovolemia	Rapid fluid replacement (rapid transport, whole blood is best)

Take-aways
Traumatic arrest remain load and go situations due to interventions available at the hospital which are not available in the out of hospital setting: drownings and electrocution are included in Traumatic arrests
The leading preventable causes of death in TCA are: Airway obstruction, Hemorrhage amendable to a tourniquet or pressure, and tension pneumothorax.
The lethal triad needs to be understood by all ALS providers and guarded against: Hypothermia, Acidosis, and coagulopathy.
Remember Spinal motion restriction as part of airway management in TCA caused by blunt injury.
Have a low (very low) threshold for bilateral decompression in TCA.
Near-future changes in TCA care may drastically alter the care model for this patient population.

ITLS High Threat is HERE!

The ITLS High Threat for Military and Civilian Providers course manual has arrived!

OVERVIEW:

Responding to injured personnel has traditionally been the responsibility of medical components of units operating in high-threat environment. Experience from the global war on terror and civilian mass violence events have demonstrated that all operators have an important role to play in minimizing possibly preventable deaths.

Moreover, in the civilian sector, the need for combined law enforcement/fire/emergency medical services (EMS) operations has become increasingly apparent in responding to these tragic events. Novel operational tactics and an awareness of altered priorities of care in the high-threat environment are key to successful operations. Based upon this premise, the International Trauma Life Support High-Threat for Military and Civilian Providers Course makes use of the most up-to date operational medical experiences to save lives both while under immediate threat and once the threat has been mitigated.

THE GOAL OF HIGH-THREAT MEDICINE:

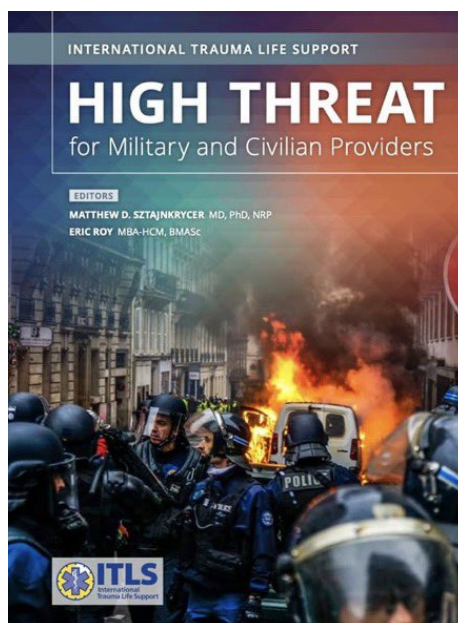
High-threat care is predicated upon the goals of ensuring mission success while offering prompt tactically appropriate response to the injured. It involves rescuing, performing life-saving interventions, and ultimately evacuating casualties initially to safety and

eventually to definitive care, all while attempting to ensure one's safety.

In order to best accomplish these objectives, ITLS High-Threat for Military and Civilian Providers draws from the global experiences of high-threat medical operators, while remaining compliant with the principles of military Tactical Combat Casualty Care (TCCC) and civilian Tactical Emergency Casualty Care (TECC). It focuses not so much on the instruction of medical procedures (eg IV access) but rather emphasizes the tactical application of such skills in terms of time and tactical situation. In this regard, the course is built around dynamic skill stations more so than static slide decks.

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Illinois Chapter Price: \$49

HOW TO ORDER:

Orders can be placed by emailing Bookstore@icep.org to automatically receive the Illinois discounted price offered by ICEP. Illinois state tax and shipping costs will be added. Training sites with tax-exempt status should indicate that when placing their order(s). Orders should include a ship to address and billing address if different. ITLS training sites can be invoiced with payment due in 30 days. Individuals are required to prepay with a credit card or check with the order shipping after payment has been received.

ITLS High Threat Instructor materials are being finalized and ready for release soon. They will include ppt teaching slides and an instructor guide and will be at no cost to approved High Threat instructors through the chapter.

Requirements for teaching the High Threat course will be sent to Illinois course coordinators and affiliate faculty when the information is received from ITLS International.

Contact Sue McDonough with questions about the course or ordering manuals at suem@icep.org.



International Trauma Conference
November 2-4, 2022
Tampa, Florida, USA

Conference Location

Hilton Tampa Downtown
 211 N Tampa Street, Tampa, Florida, USA, 33602
 Book online: itrauma.org/tampa
 Toll Free Number: 888-225-9664 or 813-204-3000

The Hilton Tampa Downtown is located in downtown Tampa, two blocks from the Riverwalk. The rooftop pool boasts views of the surrounding area, a sundeck, and whirlpool, and also a 24-hour fitness center, restaurant, bar, and on-site Starbucks. The conference room rate is \$149 for either 2 double beds or 1 king bed. The group code is "ITC1" or can be found by clicking the link above or calling the hotel directly. The discount code is good for any day of stay between November 1st and 5th and **MUST** be booked **no later than Friday, October 7, 2022.**

More information and registration for the conference will be available shortly. Continue to check back at itrauma.org/conference for all the details.

In Memoriam

Matt Moyes, NRP, CCEMT-P, RN, TNS, ASM-C, passed away in September 2021 after a long illness. Matt served on the ITLS Illinois Advisory committee and was a long time ITLS course coordinator, affiliate faculty and instructor. He was dedicated to promoting and developing ITLS training at new sites. He touched many lives by sharing his knowledge.

Advisory Committee News

Welcome to new Advisory Committee members Mike Dant, EMT-P, EMS Program Director at Illinois Central College, Peoria, and Karyn Eisemann, Administrative Coordinator, at Memorial Hospital, Belleville.

Thank you to Rosemary McGinnis, RN, TMS, and Dave Meiners, NREMT-P, FP-C, who are stepping down from their roles as members of the ITLS Illinois Advisory committee.

Both have served on the committee for many years and have represented the ITLS Illinois chapter at ITLS annual conferences as voting delegates.

Rosemary is a course coordinator, affiliate faculty and instructor who enjoys her interactions with students and faculty. She mentored new course coordinators and instructors and brought ITLS courses to new sites.

She received the ITLS Ray Fowler Instructor of the Year Award at the 2019

ITLS International conference in Las Vegas. The award is for Excellence and Innovation in Teaching ITLS Programs.

Dave is a dedicated affiliate faculty and instructor and is always willing and available to teach, mentor and monitor students and new instructors at courses near and far. Dave celebrated 50 years as a National Registered Paramedic in January 2022. Congratulations, Dave!

Congratulations to New Affiliate Faculty Members

Matthew Smetana, DO, FACEP, NRP, of Mercyhealth System, Rockford, and Dennis Stanford, EMT-P, of OSF St.

Anthony's Health Center, Alton, were approved in April 2022 as new Affiliate Faculty.

Contact Sue McDonough at suem@icep.org if you are interested in applying or submitting a nomination.

2022 ITLS Illinois Advisory Committee Meetings Set for August 26 and December 2

There are two meetings of the ITLS Illinois Advisory Committee remaining in 2022: August 26 and December 2. Both meetings will be held from 10:00 to 11:00 AM via Zoom for videoconference or audioconference participation.

In-person meetings and locations will be announced closer to the meeting date and determined based on CDC guidelines. As a reminder, all Affiliate Faculty are required to attend one meeting every 2 years; videoconference or audioconference meets the attendance requirement.

Attendance at additional meetings is optional but appreciated!

ICEP and ITLS are moving to a new location effective May 6, 2022.

2001 Butterfield Road
Esplanade I, Suite 320
Downers Grove, IL 60515

ITLS 9th edition etrauma Coming in May 2022

Pearson Education has confirmed the 9th edition etrauma course is ready for release and can soon be purchased on their site.

There will be three different options for purchase in the U.S.

- Access code only \$77.00
ISBN# 9780136959908
- Access code with 9th edition etext \$109.00 ISBN# 9780137206209
- Access code, 9th edition etext and hard copy print book \$182.67
ISBN #9780137322923

The etrauma course online is available for completion for one year from the student's first date of access.

Upcoming ITLS Illinois Courses

For the most updated list of upcoming courses in ITLS Illinois, including registration information, please visit <http://cms.itrauma.org/CourseSearch.aspx>. You do not need to log in to access this page. Here are some of the upcoming courses in Illinois:

May 20: Advanced Provider Rapid Renewal
Registration: Randy Stroud - rstroud88@gmail.com
El Paso Emergency Squad, El Paso

June 7: Combined Provider Recertification
June 8-9: Combined Provider Certification
Registration: Danelle Geraci - danelle.a.geraci@osfhealthcare.org
Peoria Area EMS, Peoria

June 30: Combined Provider Recertification
June 30-July 1: Combined Provider Certification
Registration: Dean Buch - dbuch@medstarems.net
Medstar Ambulance, Belleville

July 12 & 16: Advanced Provider Certification
Registration: Nick Fish - nick_fish@ivcc.edu
Illinois Valley Community College, Oglesby

August 25: Combined Provider Recertification
August 25-26: Combined Provider Certification
Registration: Dean Buch - dbuch@medstarems.net
Medstar Ambulance, Belleville

October 11: Combined Provider Recertification
October 12-13: Combined Provider Certification
Registration: Danelle Geraci - danelle.a.geraci@osfhealthcare.org
Peoria Area EMS, Peoria

October 11: Combined Provider Recertification
October 15-16: Combined Provider Certification
Registration: Jason Wright - jwright@sblhs.org
Sarah Bush Lincoln Health System, Mattoon

October 20: Combined Provider Recertification
October 20-21: Combined Provider Certification
December 15: Combined Provider Recertification
December 15-16: Combined Provider Certification
Registration: Dean Buch - dbuch@medstarems.net
Medstar Ambulance, Belleville