

Blood on the Ground

 [emsworld.com/node/215693](https://www.emsworld.com/node/215693)

It's 2:30 in the morning, and Cypress Creek EMS is responding to an emergency call in Harris County, north of Houston. The patient has severe injuries and massive internal bleeding from a 40-foot fall—he's lost a lot of blood. Normally his survival would be considered extremely doubtful.

But this time is different. CCEMS can intervene more effectively because of new protocols instituted just nine hours prior. Cypress Creek EMS field supervisors now carry fresh plasma and packed red blood cells, and CCEMS is about to perform its first-ever transfusion in the field.

"The patient was in and out of consciousness, very pale, cool to the touch and had no pulse," recalls field supervisor Samuel Kordik. "There wasn't even enough blood pressure to get blood to the wrist. By all visible signs this was a very sick patient who was severely injured. What I'd expected based on my experience was for this patient to continue to deteriorate and become completely unconscious and possibly even die on the way to the hospital."

But when the transfusion of fresh plasma and packed red blood cells began, the result was very different. In fact, Kordik describes the results as amazing.

"What was most impressive," he says, "is that the patient was able to wake up, give us his name and talk to us all the way to the hospital. That was totally unexpected—his blood pressure got better, his color actually got a little bit better. We could tell the patient still had significant internal bleeding because the abdomen became more rigid. The blood we were giving was enough to offset the blood loss, allowing the patient to become more awake. He was getting oxygen to his brain and actually able to start responding to us." And this was all accomplished on the way to the hospital.

The patient survived, and EMS history was made by Kordik and CCEMS Medic 57, which included paramedic Jessica McClosky, EMT Joel Kordik, volunteer Jeremy Claxton and paramedic student and EMT James Burton. About two months later the patient walked up to one of the crew at a Starbucks to say thank you. He was on crutches but getting around well on his own.

Memorial Hermann Life Flight had been carrying and transfusing fresh plasma and packed red blood cells in its helicopters for about five years. It's had much success and no adverse reactions to its universal-donor blood products. Now the same lifesaving protocols have been extended to ground EMS in Texas for the first time.

"It takes the right unit, the right people and the right organization," says Memorial Hermann trauma surgeon John Holcomb, MD. "For the early adopters there's money involved; there's logistics, and you guys are leading the way on the ground. There are a number of helicopter services around the country that carry red blood cells. There are fewer that carry fresh plasma and packed red blood cells. We think it's important to have that balanced approach. There are very, very few ground units across the country carrying any blood products."

Holcomb, who previously served 23 years in the Army as a trauma surgeon, says he doesn't know of any ground EMS systems in the country that carry both fresh plasma and packed red blood cells except for CCEMS and the Harris County ESD 48 Fire Department.

Holcomb serves as cochair of the South East Texas Regional Advisory Council (SETRAC) Trauma Committee. He says the ground blood program began with his cochair, Eric Bank, asking a question. With the obvious success Life Flight was having, Bank asked, why can't we do that on the ground?

Bank is assistant chief of EMS at the Emergency Services District (ESD) 48 Fire Department in west Harris County, and he was eager to give it a try. Holcomb, who also serves as an instructor for Cypress Creek's twice-yearly tactical

medic training, suggested bringing CCEMS in as a partner.

It took more than a year to work out the details and finalize medical protocols with the Gulf Coast Regional Blood Center; those protocols also had to be approved by CCEMS medical director Levon Vartanian, MD, before Cypress Creek could begin.

Under the CCEMS protocols patients must meet certain criteria.

Adult patients (at least 12 years old) must present with two or more of the following to meet the criteria for blood products:

- Heart rate greater than 120;
- Systolic BP at or below 90;
- Penetrating injury or significant blunt traumatic injury;
- Hemoglobin of 7 or less.

Pediatric patients (ages 1–11) must present with two or more of the following to meet the criteria for blood products:

- Heart rate greater than 150 (age-dependent);
- Systolic BP equal to or less than 70 plus the child's age in years times two;
- Penetrating injury or significant blunt traumatic injury;
- Hemoglobin of 7 or less.

Patients who meet the above criteria receive an IV of Plasma-Lyte A followed by one unit of fresh plasma and then one unit of packed red blood cells. Plasma is given first because it contains clotting factors and is a volume expander. In a critical resuscitative case, fresh plasma and packed red blood cells are given at the same time through separate IV lines.

Blood products can be administered through intraosseous access, and when a pressure infuser device is used, the pressure is not to exceed 280 mm Hg.

If the adult patient or parents/guardians of a pediatric patient refuses transfusion for religious, social or personal reasons, the refusal must be clearly documented. In case of refusal, we instead administer Plasma-Lyte A.

Although cases of allergic reactions to blood products are rare, medics still must watch for the symptoms and discontinue the transfusion should they appear. At that point medics would switch to Plasma-Lyte A and treat for the allergic reaction. In the nearly five years Life Flight has been carrying and transfusing blood products, there has not been a single incident of allergic reaction.

Specialized equipment to make this innovation possible at CCEMS was funded by Harris County ESD 11, including two clinical-grade Helmer refrigerators, four clinical-grade coolers, point-of-care hemoglobin meters and portable devices (buddy lite fluid warmers) to warm the chilled fresh blood products to body temperature as they are being transfused.

The blood product protocols are based on those used by Life Flight and were piloted on the ground by the Harris County ESD 48 Fire Department beginning in February 2016.

As of August 24, 2016, Cypress Creek's field supervisors began carrying universal-donor fresh plasma and packed red blood cells at all times.

While being carried in the vehicles, the blood products are kept at the proper temperature in special clinical coolers. A remote temperature monitor on the dashboard gives field supervisors a constant readout of the temperature inside

the cooler.

Because packed red blood cells have a shelf life of 20–30 days, the inventory is rotated weekly by the Gulf Coast Regional Blood Center to make sure the fluids are used in other settings while still viable. Cypress Creek’s inventory is stored in Helmer refrigerators that are so sophisticated, they can send texts and e-mails and even make phone calls to designated staff if a malfunction or rise in temperature is detected. The blood products are maintained at a temperature range of 2–6°C. The Helmer refrigerators have triple-redundant clinical thermometers, and the temperature is recorded every 12 hours by a supervisor.

Based on the experience of Memorial Hermann Life Flight and PHI Air Medical in southeast Texas, we are certain more lives will be saved by having blood products available on the ground. Holcomb says about 1,600 people die of trauma in the Houston area each year. He says it’s estimated that about 35% of those could be saved with earlier intervention. That’s 560 people a year. Cypress Creek alone has identified 110 trauma cases from 2015 in which the patients would have been candidates for blood, and that does not include medical cases.

Why It Matters

ESD 48, which piloted the protocols, serves more than 130,000 people in a 45-square mile area of west Harris County. Between February, when its program started, and August, ESD 48 transfused blood products in six cases. All were medical in nature, but in early May HCESD 48 was on scene and prepared to transfuse blood products at an active shooter situation due to a mutual aid request from the Westlake Volunteer Fire Department.

Cypress Creek EMS serves more than half a million people in a 177-square-mile area of Harris County, which is larger in population and land mass than the city of Atlanta. Based on 2015 data from 33,461 calls, it was estimated CCEMS would transfuse blood products up to 10 times a month for trauma cases alone.

In the first two months CCEMS transfused blood products a dozen times (eight trauma cases and four medical). Here’s the breakdown:

- 4 auto-vs.-pedestrian accidents;
- 1 fall from height;
- 1 gunshot wound;
- 1 motor vehicle incident with entrapment;
- 1 laceration from an assault;
- 1 cardiac arrest from bleeding related to cancer;
- 3 cases of hemorrhagic shock related to internal/GI bleeding.

The patients ranged in age from 16–91 with a median age of 34. Most of the administrations were to men in their 20s and 30s.

Of the 12 patients, 11 arrived at the hospital alive. One, whose internal bleeding was caused by terminal cancer, did not survive. Six were transported by ground, six by Memorial Hermann Life Flight.

CCEMS had expected most cases to be the result of trauma, including vehicular accidents, industrial accidents, shootings, stabbings and accidents involving power tools. But so far we’ve also seen a number of nontrauma medical cases.

In these types of cases, replacement blood cells are likely the only way to save the patient. Red blood cells carry oxygen and nutrients to the cells in the brain and body. Plasma is a natural medium for the cells that replaces volume and helps facilitate clotting.

In more serious bleeds, such as a compromised artery, a patient can be unconscious in less than a minute and dead in less than five. In most cases an ambulance can't even get to a scene in five minutes.

That's why these new protocols are so critical. It's also why it's vitally important to train firefighters, police officers and the general public to stop bleeding and make that training for the public as common as classes for CPR. See more on the Stop the Bleed program below.

Trauma is the No. 1 cause of death among Americans under 46 years of age and overall is the No. 3 cause of death after heart disease and cancer. It's estimated that about one-third of the 200,000 trauma deaths in the U.S. each year are due to extreme blood loss, which starves the body of the cells that carry life-sustaining oxygen and nutrients. If you apply Holcomb's estimate that 35% of trauma deaths could be prevented with earlier intervention, that means 70,000 or more lives could be saved each year in the United States.

Stop the Bleeding

Having blood products immediately available in the field will no doubt save lives, but it is imperative that whomever is first on the scene know how to stop the bleeding.

Members of the CCEMS tactical medic team have been training firefighters and police officers to stop bleeding with tourniquets and bandages since the late 1990s. As a result many police officers and firefighters now carry Combat Application Tourniquets (C-A-Ts). In addition, CCEMS has been training every police cadet class at the University of Houston-Downtown since 2013. That's about 480 cadets a year.

Now, under the Stop the Bleed program, endorsed by the Department of Homeland Security, White House and NAEMT, CCEMS is teaching civilians the Bleeding Control course, B-CON, developed by NAEMT and the American College of Surgeons Committee on Trauma. Through a partnership with SETRAC, CCEMS is training hundreds of area medics, firefighters, police officers, doctors and nurses who have made a commitment to provide the training to the general public. In this train-the-trainer program, SETRAC provides classroom space and the seed money for educational materials and training equipment. SETRAC is also coordinating Stop the Bleed training throughout its nine-county region.

The goals of Stop the Bleed are to make the training as common as CPR training and to have a bleeding control kit mounted next to every public AED, complete with enough pressure bandages and C-A-Ts to treat up to eight patients, as recommended by the Hartford Consensus.

Since civilians are usually the first people at EMS scenes, the Hartford Consensus defines them as immediate responders. It's critical for them to know what to do to stop the bleeding while professional responders (EMS/fire and police) are on the way. We've already trained thousands of firefighters and police officers for when they reach a scene first. Similarly preparing civilians is the next logical step, along with having blood products available for transfusion in the field.

The Stop the Bleed program in southeast Texas is made possible through a partnership that includes SETRAC, its trauma committee, the Memorial Hermann Red Duke Trauma Institute and Cypress Creek EMS.

The recommendation to train citizens and all first responders to stop bleeding came out of the Hartford Consensus, a joint committee of the nation's leading medical, public safety and legal experts that was formed to recommend ways to increase survivability in mass-casualty incidents such as active shooter situations (Holcomb is a member). The formation of the committee was in direct response to the 2012 mass shooting at Sandy Hook Elementary School in Newtown, CT, which left 20 children and six staff members dead.

Levon Vartanian, MD, has served as the medical director for Texas' Cypress Creek EMS since 1998. He began his emergency medicine career as an EMT-Basic and paramedic at Galveston EMS and continued to work there while he studied medicine at University of Texas Health Science Center in Houston. He obtained his medical degree in

1994 and entered an emergency medicine residency in Little Rock, AR. Upon becoming a board-certified emergency physician in 1996, Vartanian returned to Houston to begin his career.

Wren Nealy is special operations director for Texas' Cypress Creek EMS. He has 24 years of experience as a paramedic and 19 as a police officer. He is the former assistant SWAT commander for the Waller County Sheriff's Office and now serves as a reserve lieutenant. Nealy cofounded the CCEMS bike and tactical medic teams and commands both. He also serves as lead instructor for the basic tactical operational medical support course for tactical medics taught twice a year at CCEMS. Nealy is also vice chair of the Emergency Services Sector Coordinating Council (ESSCC), which advises the U.S. Department of Homeland Security on important issues concerning emergency readiness.

Norm Uhl is an award-winning radio/television journalist and newsroom manager. He has worked for more than a decade in the field of public and media relations and was for a number of years the spokesman for one of the largest school districts in the nation. Currently he serves as public information officer at Texas' Cypress Creek EMS. CCEMS serves more than 500,000 residents across 177 square miles, an area larger in land mass and population than the city limits of Atlanta.