



SAMMY GRAM

PARKVIEW
SAMARITAN

25

YEARS

Vol. 1, Issue 1

Leaving them in the cold: Are we missing something?

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I know we all want to do what is best for all of our patients. Military and trauma surgery data indicates that some simple modifications to our practices will decrease mortality in our severe trauma patients. It's called the "Lethal Triad", a combination of Hypothermia, acidosis and coagulopathy. They build a cycle that leads to death for many trauma patients.

The parts they play:

Hypothermia: Decreases platelet clumping and adhesion. Coagulation factor activity decreases by 10% for each degree that the core temperature decreases. When the body temp reaches 89.6 F, patients with severe trauma have a near 100% mortality rate.

Shock: Patients in shock are unable to effectively distribute blood and O2 to the cells. This leads to tissue ischemia... which leads to poor ATP production... which leads to poor metabolic heat production... which leads to more hypothermia. You get the picture. Shock initiated anaerobic metabolism not only produces the lactic acidosis, it also inhibits the body's ability to maintain normothermia.

What can we do? We can't change the environmental factors that our exposed patients encounter in any number of other outdoor incidents that hurt people in cold weather. There are at least two things that



we could modify that may improve outcomes for these cold patients.

1. **Casualty covers** with active re-warming. The military has been using these for over a decade. They are a lightweight, multi-layer cover that looks like a sleeping bag with Velcro closures. These contain a chemical warmer pad that warms to 104-106 degrees. These are placed over the anterior trunk of the body under the cover. These cover/warmers prevent passive heat loss as well as providing some active re-warming over the Pt's chest and abdomen.
2. **Warm IV fluids.** Even IV fluids that have been warmed in a warmer lose a lot of heat on the way down the tubing to the Pt. You can imagine that giving a couple of liters of 70 degree IV fluid directly into the blood stream does for core temperatures. There are now a few types of EMS friendly portable IV warmers that have the heating component less than a foot from where the fluid enters the body. They are capable of delivering 104 degree IV fluid or blood to the patient even at rapid flow rates.

Coagulopathies- At the beginning of a large scale blood loss, there is a dump of chemical messengers or "mediators" like platelet activating factor and a host of others that trigger the clotting cascade. These factors are being used up as they do their work. Even worse, the mediator "shower" also can trigger the body's plasminogen to plasmin conversion that actually starts to break down fibrin clots in the massively bleeding patient.

What can we do about this aspect of the triad?

TXA (Tranexamic Acid): A simple 1 gram infusion can interfere with Plasminogen activation and clot breakdown in the bleeding patient. This drug is reasonable in cost and has a long and established reputation earned in multiple studies. TXA is used extensively by the military and more and more by trauma centers and EMS systems around the world.

Avoid overuse of crystalloids. I think everyone in EMS is familiar with the "permissive hypotension" concept in the trauma patient. An SBP of 90-100mmHg is adequate in most bleeding patients. (In TBI's attempt to maintain MAPs 65-70 range.) Over-aggressive loading with crystalloids that increase BPs even to above normal levels are not only increasing bleeding rates, and blowing loose forming clots, but are also diluting available clotting factors in the blood. (Follow local protocols.)

Acidosis- There are a few things we can do about this one in the field, below are a few goals that will help.

Prevent and manage hypothermia.

Avoid overloading with crystalloids. The nominal pH of normal saline is 5.0, of LR is 6.0. Most PRBCs at 2 weeks of age have a pH less than 7.

Control all external bleeding. Head/scalp wounds seem to be a neglected area for us. Finger pressure on the bleeder(s) seems to work best. Dressings often fail to control small arterial scalp bleeders costing even a pint of blood or more. Provide oxygen and IV fluids as needed to maintain SBP of 90-100mmHg.

Please consider these things to benefit your critical trauma patients. For the most part,

they are rather inexpensive and simple to do. If you would like any info regarding the equipment or covers we are using, please call the flight crew at (260) 266-3541 and we can get someone to assist you.



Additional reading: Some examples of fine articles/data on these topics.

<http://emcrit.org/wp-content/uploads/resus-of-crit-ill-trauma-patients.pdf>

<http://www.uptodate.com/contents/coagulopathy-associated-with-trauma>

Look into: The CRASH-2 trial, the MATTERS study and the Resuscitation Outcomes Consortium

Samaritan Pilot Biography

Andrew Lytle

Started with Samaritan in November 2014, he is an instrument rated commercial pilot and certified flight instructor with roughly 3,200 hours of flight time. He began in aviation in 2004 while serving with the United States Air Force as a crew chief (mechanic) on a Lockheed-Martin F-16 Fighting Falcon. Andrew started flying helicopters in early 2007. Previous flying experience includes: Flight instruction (Iowa and Utah) Tours (South Dakota around Mount Rushmore), Pipeline and power line contracts (Oklahoma City), Offshore Oil and Gas (Louisiana/Gulf of Mexico), and EMS (Chicago). Andrew lives in his hometown of Sturgis, Mich., with his wife, Gena, and two children, Brinleigh and Bryce. In addition to flying for Samaritan, Andrew serves as a reserve police officer for the City of Sturgis.

