Pre-hospital Whole Blood
Optimizing survival for hemorrhagic shock patients

Pre-hospital whole blood programs implemented by ground and air EMS systems are game changers in survival for hemorrhagic shock patients. Optimize field damage control resuscitation (DCR) by understanding the importance of preventing the lethal triad and early warmed whole blood administration at the point of injury.

While MEDEVAC and select military units operating in the prehospital environment have carried cold stored blood products for several years, recent advances have expanded the use of cold stored blood products throughout military and civilian EMS systems. In 2016 military units began carrying and administering Cold Stored – Low Titer O Whole Blood (CS-LTOWB) with several civilian EMS agencies following suit shortly after.

Initiated in 2018, the large scale San Antonio, TX regional prehospital CS-LTOWB program is proving whole blood can be safely fielded by urban, suburban, and rural EMS systems. Lives are being saved with ground EMS forward carried whole blood administered immediately at the point of injury.

A recent study examined the association of prehospital transfusion and the time to initial transfusion with injury survival. Among medically evacuated US military combat causalities in Afghanistan, blood product transfusion prehospital, or within minutes of injury, was associated with greater 24-hour and 30-day survival than delayed transfusion or no transfusion. The findings support prehospital transfusion in this setting.

As part of the lethal triad (fig. 2), hypothermia can have a detrimental effect to trauma patients, especially those suffering from catastrophic hemorrhage, by affecting the coagulation pathways. A decrease in core body temperature has been demonstrated to increase mortality in patients suffering hemorrhagic shock. Mortality increases predictably with successive increases in lactate levels and the detrimental effects of acidemia are compounded while survival is markedly reduced by hypothermia with a core temperature <93°F.

Coagulation factor activity is reduced approximately 10%–15% for each 2°F drop in temperature, which is exacerbated by factor depletion secondary to dilution, leading to increased mortality.

Patient temperature and its effect on oxygen delivery

The above graph (fig. 3) depicts oxygen affinity for heme molecules in blood cells – the Oxygen-Hemoglobin dissociation curve. Several factors can adjust the curve left (which results in a decrease in oxygen unloading at the tissues) or right (which results in an increase in oxygen unloading at the tissues).

As patient temperature decreases, the curve shifts to the left which decreases oxygen delivery at the tissues and thus worsening shock. As patient temperature increases

the curve shifts back to the right, which results in a reduced affinity of hemoglobin for oxygen. Consequently, as temperatures increase towards normothermia, the unloading of oxygen at the tissues in enhanced resulting in improved treatment of hemorrhagic shock.

Cold store whole blood is a limited and valuable resource, it is imperative that it is administered for maximum efficacy.

Data demonstrates that optimizing the temperature of both fluids and blood should be integrated as a crucial part of the damage control resuscitation protocol for all trauma patients in prehospital environment thereby reducing the risk of cardiac anomalies, optimizing a greater unloading of oxygen to tissues by hemoglobin and ensuring end-organ hypo-perfusion is minimized in a shocked state particularly in relation to catastrophic hemorrhage and those that have lost significant volumes of blood.

The Quantum Blood and Fluid Warmer is the next generation solution to point of injury infusion or transfusion warming. The Quantum is the enabling technology which reduces the set up and thermal control process to its most intuitive form.

It is the first blood and fluid warmer that the heating system is integrated into the form factor of a conventional transfusion or infusion set. It looks, handles, and primes exactly like a conventional infusion or transfusion set. And unlike any other warmer on the market, it requires no additional tubing or bulky cartridge to be carried or the extra steps of set up and complexity those systems require.

The Quantum was co-developed with support of the US DoD under the program management of the USSOCOM to fill the capability gap for an effective ultralight warmer to be carried far forward by a dismounted medic at the point of injury.

At only 22 ounces operational weight, it is the lightest battery powered blood warmer ever developed, and the most intuitive to set up and use.

The Quantum battery has capacity to warm 1000 mL of refrigerated blood from 39°F (4°C) to 100.4°F (38°C +/- 2°C) with a warm-up time of just 24 seconds, and recharges in only 90 minutes or less.

The significant performance advantages of the Quantum has led to quick adoption by top tier military units, as well as civilian EMS/HEMS fielding prehospital blood or warming IV solutions.

The Quantum is FDA cleared and indicated for warming blood, blood products, and intravenous solutions prior to administration in adults and infants greater than 28 days old and of normal birth weight. It is intended for use by healthcare professionals in the hospital, clinical, field, and transport environments to help prevent hypothermia. The Quantum is not indicated for use in neonates (0–28 days old) and infants of low birth weight. CE Mark for the European Union is pending.

Contact us for an onsite demo of the Quantum Blood and Fluid Warming System.