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KEY POINTS

- Critical bleeding in trauma is usually resolved within 2 hours
- Low-titer Type-O Whole Blood reduces but doesn't eliminate the risk of an immune reaction
- Whole blood has an economical and logistical cost, which is not insurmountable

This space recently featured a pair of articles debating the merits of prehospital plasma as a primary resuscitation fluid for trauma patients in hemorrhagic shock. The articles, a [Pro:Con](#) in two parts, were based on a pair of studies funded by the US Department of Defense. The first looking at helicopter EMS (where the authors found a benefit to plasma vs. crystalloid) and the latter, at urban ground ambulance system (where no benefit was discovered). The back and forth highlighted the importance of timely care for hemorrhage (speed wins!) and debated issues related to methodology and presentation of prehospital research. The whole thing was fun for the engaged membership of the Trauma Anesthesiology Society, but alas! the exercise will soon be rendered moot.

**Editorial
Comment:**
Holding my
breath...

Why? Because something better is already here: Whole Blood.

A physician-focused panel at the recent [Advanced Law Enforcement Rapid Response Training](#) (ALERRT) conference in Dallas included a series of presentation on the use of Whole Blood in resuscitation, both in the trauma center and during prehospital transport. The panel was arranged by our own Alan Frankfort. [Professor John Holcomb](#) set the table by observing that critical bleeding after trauma is typically resolved - win or lose - in the first two hours after injury. [Professor Don Jenkins](#) followed by describing use of whole blood by the military in Iraq and Afghanistan -- and more recently in his civilian hospital. He showed data on the efficacy of whole blood as a resuscitation fluid, even when compared to early and well-balanced use of blood components. But the real eye-opener was the talk by



Elizabeth Walton, Director of the South Texas Blood and Tissue Center, describing - in the real world - how they were delivering whole blood units for prehospital administration in the San Antonio area.

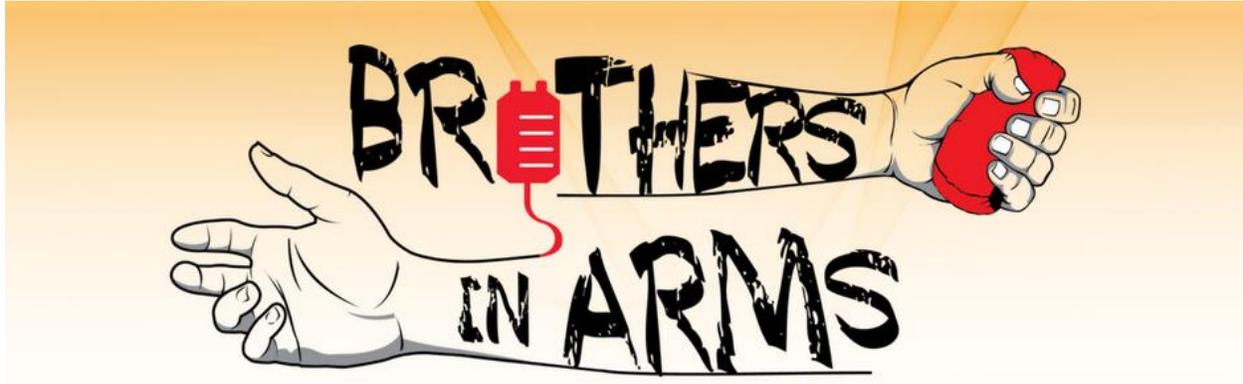
Whole blood was used for trauma resuscitation prior to and during the Vietnam War. Post-Vietnam, the fact that most (non-trauma) transfusion recipients need only a single component of blood, recognition of the immune issues created by whole blood resuscitation and the new technical ability to separate donated units into constituent parts led to rapid adoption of component therapy. By 1990 component red blood cells, plasma, platelets and cryoprecipitate were the only products available in civilian trauma centers. In the early years of the global war on terror, however, long logistic chains made frontline supply of blood components difficult, leading to field-expedient use of the "walking blood bank" to supply fresh whole blood for resuscitation. Empiric observation by experts such as Professors Holcomb and Jennings suggested that this approach was not only expedient, but might also be better. Several US trauma centers, including both UTH and UTSA, have now regained access to fresh whole blood for acute resuscitation. Blood banking services, such as the Red Cross, are now making whole blood units available to trauma centers in many cities.

But what about prehospital use? Is this really a good idea?

A whole blood transfusion? What, are you crazy? Whole blood includes a lot of different parts, including both antigens and antibodies. These carry the risk of harm, just like any transplant. On the antigen side the risk is mitigated by the exclusive use of type-O - - universal red cell donor -- whole blood. On the antibody side, the type-O units selected are those with low-titers of anti-A and anti-B antibodies. The specific stuff dished up by the South Texas Blood and Tissue Center is Low-titer Type-O Whole Blood, identified by the somewhat clunky acronym "LTOWB." The Blood Center has cultivated a network of qualified donors, and created the "Brothers in Arms" program to encourage



them. Further immune mitigation comes from using only male donors, which reduces the risk for transfusion-related acute lung injury (TRALI).



TRANSFORMING TRAUMA CARE

Another concern might be the viability of the clotting components. The LTOWB units used prehospital in South Texas are kept at 4°C and are good for 21-35 days (depending on the anticoagulant added to the unit). There is a predictable time-based fall off in coagulation factor concentration over this time, which is true also in any thawed or liquid plasma product. Traditional thinking would have us believe that platelet number and activity would decrease rapidly, but the recent recognition that cold activated platelets may be a better pro-thrombotic product than room-temperature platelets challenges this belief (another discussion, for another day). Preliminary data on banked whole blood suggests that it supports in vivo clotting at least as well as component therapy, but there is way more science yet to come on this topic.

Finally, there are the logistic concerns. Whole blood units are easier to deliver than component therapy - no centrifuge required! - but economically challenging because only one product is produced per donation, rather than 3. So whole blood units cost more, but not prohibitively so. Maintaining them in prehospital EMS units requires management of on-board refrigerators as well as options for delivery, outdateding, and replenishment. The Blood Center has figured all of this out, however, and Ms. Walton noted that refrigerated units were easier to manage than the frozen plasma units used in the Denver ground EMS



study referenced above, which required carefully calibrated microwave thawing prior to delivery. She did not discuss wastage of unused LTOWB units, other than a hint that older whole blood could be pulled back to the Blood Center and then reprocessed for products such as cryoprecipitate.

On balance, it seems as if the technical issues are easy enough to resolve. While fresh whole blood can be delivered through a volunteer walking blood bank program - coming soon to a trauma center near you - banked LTOWB units seem like the best possible solution for prehospital use. There is no question that blood-based resuscitation is more effective the earlier it's given to a patient in hemorrhagic shock; the biggest question about prehospital LTOWB units is whether the immune and logistic challenges are outweighed by the benefits of whole blood compared to RBC and plasma units. My guess is that whole blood will be proven efficacious. Whole blood units reduce viral exposure, with all components coming from a single donor, and it may be that getting one immune-consistent whole blood unit is better than getting pieces of multiple units from different donors. The analogy would be matching the Super Bowl-winning football team which has played and practiced together for years against a pick-up team just assembled. Even if the picks are all-pro players, I would bet on the benefits of team coordination.