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Whole Blood in Trauma

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Whole Blood in Trauma

Abstract

Abstract: Hemorrhage is a leading cause of death in trauma patients. Whole blood administration in trauma has gained a renewed interest in recent years, however the concept is not new at all, with its origins spanning over 100 years. Field experience in United States' military conflicts has provided important data on the efficacy of whole blood in reducing mortality and amount of blood product administration. Civilian trials however have not necessarily shown similar results. The safety of whole blood however does not seem to be in question given the available data, and is an acceptable option for blood replacement in the hemorrhaging trauma patient.

Keywords

Trauma, Resuscitation, Whole Blood

Hemorrhage is often a primary factor when assessing the causes of death for trauma victims. Therefore, early administration of blood products is critical in reversing potential causes of death in an injured patient that is hemorrhaging.¹ Traditionally, in civilian trauma care, blood products have been administered as individual components. When large amounts are administered, typically greater than ten units, massive transfusion protocols are initiated to ensure that patients receive appropriate volume of components, including packed red blood cells, platelets and fresh frozen plasma.² However, a 1:1:1 approach of components still is not the same as whole blood.¹ As a result, there has been renewed interest in assessing the effectiveness of whole blood transfusion versus component administration.

The military has used whole blood for over one hundred years. Through each of the major military conflicts that the United States was involved in throughout the 20th century, use of whole blood was improved and instrumental in saving the lives of military personnel. Interestingly, in each conflict, the lessons learned in prior conflicts was often disregarded until reexplored and reimplemented. It was not until the mid-2010s that exploration of whole blood use in civilian trauma picked up traction, recognizing the value that such transfusions have had on the battle field.³ Despite the continued use of fractioned component blood products in civilian trauma, whole blood was the mainstay of treatment for trauma patients throughout the wars in Iraq and Afghanistan throughout the first couple decades of the 21st century. It was found that mortality and overall utilization of blood products was reduced through the use of whole blood throughout recent battlefield traumas, which led to the Department of Defense creating guidelines for prehospital administration of whole blood.⁴

A recent multicenter trial compared crystalloid solution, blood component administration, and whole blood administration in the prehospital setting. The results found that patient receiving

crystalloid solution had a significantly lower likelihood of survival compared to those who received packed red blood cells and platelets. The survival rate of patients receiving any amount of whole blood was found to be more than twice that of those patients that received component therapy. Additionally, it was found that there was a 53% reduction in post-emergency department transfusion when whole blood was administered.⁴

Battlefield lessons have contributed to the concept of damage control resuscitation (DCR). DCR employs concepts learned from battlefield trauma, as well as civilian trauma, in an effort to provide the highest quality of care to trauma patients. Currently, DCR focuses on early hemorrhage control, permissive hypotension to encourage hemostasis, reduction in coagulopathy, judicious use of crystalloid solution, definitive hemorrhage control, and early use of whole blood or balanced component blood product administration.⁵

In civilian use, there are barriers to whole blood use from a blood banking perspective. Whereas the military can employ a standardized process, without variability, and even resort to methods such as “buddy transfusions” from one soldier to another on the battlefield when needed, such methods are not applicable in civilian use. Collection and storage procedures are standardized across the United States, however regional differences can still create variability in availability. Currently, whole blood is only collected from male donors so that the risk of transfusion related lung injury can be decreased. Rh⁺ type O blood is used because of the demand for Rh⁻ blood product. While type O blood is considered compatible across all blood types, levels of anti-A and anti-B antibodies is a concern. To protect against reactions, blood donations are screened for titer levels, and if it is below a pre-determined level, it can be used. However, there is not a universal standard, though literature has suggested acceptable levels to be used. Such blood is referred to as “low titer whole blood.” As well, the blood only has a 21-

day window to be used, unlike packed red blood cells which have a window that is twice as long. There are also differences in how the blood is treated, for example irradiation is not universal.⁶

A large study, of over 1,300 major trauma victims, found a 60% improved 30-day survival rate when receiving whole blood for hemorrhagic shock. The improved survival was demonstrated across injury types, but was found to be most important when looking at patients with a moderate to severe Injury Severity Score. Further, the use of whole blood was associated with a 7% decrease in the amount of blood products required over a 24 hours period.⁷

Interestingly, a systematic review of the current literature did not find an overall survival benefit or reduction in total number of blood products needed. The review looked at both fresh whole blood and low titer O whole blood, and in a further breakdown, there was an indication that fresh whole blood may have data that supports continued use. However, evidence to support the continued use of low titer O whole blood is limited. Despite the concluded evidence however, it was demonstrated that the use of whole blood is safe and reasonable in both the civilian and military settings, with the exception of a possible higher rate of acute kidney injury and acute respiratory distress syndrome with the use of fresh whole blood.¹

To conclude, whole blood instead of component blood products for administration in traumatic hemorrhage is not a new concept, and has roots going back over one hundred years. While opinions on the efficacy have waxed and waned over the decades, storage and administration has evolved. The U.S. military, which has significant trauma experience has found benefit in whole blood over fractionated blood, and civilian studies have similarly found benefit. However, there is also evidence that does not find benefit to whole blood, yet also does not find negative results, indicating that at a minimum, there is no downside to its use currently.

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