

Joint Trauma System, Defense Committee on Trauma, and Armed Services Blood Program consensus statement on whole blood

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Abstract

Hemorrhage is the most common mechanism of death in battlefield casualties with potentially survivable injuries. There is evidence that early blood product transfusion saves lives among combat casualties. When compared to component therapy, fresh whole blood transfusion improves outcomes in military settings. Cold-stored whole blood also improves outcomes in trauma patients. Whole blood has the advantage of providing red cells, plasma, and platelets together in a single unit, which simplifies and speeds the process of resuscitation, particularly in austere environments. The Joint Trauma System, the Defense Committee on Trauma, and the Armed Services Blood Program endorse the following: (1) whole blood should be used to treat hemorrhagic shock; (2) low-titer group O whole blood is the resuscitation product of choice for the treatment of hemorrhagic shock for all casualties at all roles of care; (3) whole blood should be available within 30 min of casualty wounding, on all medical evacuation platforms, and at all resuscitation and surgical team locations; (4) when whole blood is not available, component therapy should be available within 30 min of casualty wounding; (5) all prehospital medical providers should be trained and logistically supported to screen donors, collect fresh whole blood from designated donors, transfuse blood products, recognize and treat transfusion reactions, and complete the minimum documentation requirements; (6) all deploying military personnel should undergo walking blood bank prescreen laboratory testing for transfusion transmitted disease immediately prior to deployment. Those who are blood group O should undergo anti-A/anti-B antibody titer testing.

KEYWORDS

military medicine, walking blood bank, Whole blood transfusion

Hemorrhage is the most common mechanism of death in battlefield casualties with potentially survivable injuries.^{1,2} There is evidence that early blood product transfusion saves lives among combat casualties.³⁻⁷

When compared to component therapy, fresh whole blood (FWB) transfusion improves outcomes in military settings.⁸⁻¹¹ Cold-stored whole blood also improves outcomes in trauma patients.¹² Whole blood (WB) has the advantage of providing red cells, plasma, and platelets together in a single unit, which simplifies and speeds the process of resuscitation, particularly in austere environments.

In deployed settings, there are two types of WB currently available: (1) FWB from the Walking Blood Bank (WBB), and (2) donor center-produced cold-stored low titer group O whole blood (LTOWB).¹³ FWB should preferably be drawn from prescreened low-titer group O donors; it is non-FDA-approved due to necessary limitations in donor screening and transfusion-transmitted-disease testing.^{13,14}

Cold-stored LTOWB was introduced into the US Central Command (USCENTCOM) in 2016¹⁵ and is fully FDA-approved. When LTOWB is not available, when there is an insufficient quantity to treat severely injured combat casualties, or when a provider determines that FWB may improve life-threatening coagulopathy, FWB from a WBB may be used effectively and safely. According to studies of blood donor physiology, donation of one unit (450 ml) of fresh whole blood does not degrade performance,¹⁶⁻¹⁸ although appropriate risk mitigation measures should be in place in the event the donor also becomes wounded.

Component therapy, which includes red blood cells, plasma, and platelets separated from the whole blood from which it was derived, has commonly been used to support all types of transfusion needs since World War II. However, component therapy is technically more difficult to deliver to massively bleeding casualties (particularly in austere environments), dilutes clotting factors, and has been shown to be associated with increased mortality compared to FWB in retrospective studies of military casualties.⁸⁻¹¹ With careful donor management, a blood program based on whole blood is equally able to support large-scale operations compared to a component-based program.

Frozen red blood cell stockpiles, while attractive for contingency operations and planning due to their extended shelf life, are inadequate to support resuscitation of acutely bleeding casualties. Thawing and deglycerolization of frozen red blood cells cannot be done rapidly, and even when combined with plasma thawing, does not supply platelets, and results in suboptimal resuscitation.

The Joint Trauma System, the Defense Committee on Trauma, and the Armed Services Blood Program endorse the following:

- Whole blood should be used to treat hemorrhagic shock.
- LTOWB is the resuscitation product of choice for the treatment of hemorrhagic shock for all casualties at all roles of care.
- WB should be available within 30 min of casualty wounding, on all medical evacuation platforms, and at all resuscitation and surgical team locations.
- When WB is not available, component therapy in the order of preference specified in the Tactical Combat Casualty Care Guidelines¹⁹ should be available within 30 min of casualty wounding.
- All Role 1 (prehospital) medical providers should be trained and logistically supported to screen donors, collect FWB from designated donors, transfuse blood products, recognize and treat transfusion reactions, and complete the minimum documentation requirements.
- All deploying military personnel should undergo WBB prescreen laboratory testing for transfusion transmitted disease immediately prior to deployment. Those who are blood group O should undergo anti-A/anti-B antibody titer testing.
- A tracking system for prescreening results must be accessible worldwide to verify donor status AND be readily available for each role of care.
- All deploying military units, particularly ground combat units, should maintain a prescreened WBB roster and the capability to draw FWB at or near the point of injury.
- Personnel must be trained, and supplies must be maintained at every role of care to support a WBB for mass casualty events.
- Pre-positioned frozen red blood cell stockpiles can be considered as a means to gradually restock blood components in denied environments but cannot support a rapid need for blood during resuscitation or mass casualty events.
- Commander support of WBB, both in garrison and in deployed environments, is required for adoption and implementation of this life-saving capability.
- These recommendations should be incorporated into medical planning, pre-deployment training, and theater entry requirements.

CONFLICT OF INTEREST

The opinions or assertions contained herein are the private views of the authors and not to be construed as official or as reflecting the views of the Defense Health Agency or the Department of Defense.

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REFERENCES

- Eastridge BJ, Mabry RL, Seguin P, Cantrell J, Tops T, Uribe P, et al. Death on the battlefield (2001–2011): implications for the future of combat casualty care. *J Trauma Acute Care Surg.* 2012;73(6 Suppl 5):S431–7.
- Mazuchowski EL, Kotwal RS, Janak JC, Howard JT, Harcke HT, Montgomery HR, et al. Mortality review of US special operations command battle-injured fatalities. *J Trauma Acute Care Surg.* 2020;88:686–95.
- Kotwal RS, Howard JT, Orman JA, Tarpey BW, Bailey JA, Champion HR, et al. The effect of a golden hour policy on the morbidity and mortality of combat casualties. *JAMA Surg.* 2016;151:15–24.
- Shackelford SA, del Junco D, Powell-Dunford N, Mazuchowski EL, Howard JT, Kotwal RS, et al. Association of prehospital blood product transfusion during medical evacuation of combat casualties in Afghanistan with acute and 30-day survival. *JAMA.* 2017;318:1581–91.
- Howard JT, Kotwal RS, Santos-Lazada AR, Martin MJ, Stockinger ZT. Reexamination of a battlefield trauma golden hour policy. *J Trauma Acute Care Surg.* 2018;84:11–8.
- Kotwal RS, Scott LLF, Janak JC, Tarpey BW, Howard JT, Mazuchowski EL, et al. The effect of prehospital transport time, injury severity, and blood transfusion on survival of US military casualties in Iraq. *J Trauma Acute Care Surg.* 2018;85(1S):S112–21.
- Howard JT, Kotwal RS, Stern CA, Janak JC, Mazuchowski EL, Butler FK, et al. Use of combat casualty care data to assess the US military trauma system during the Afghanistan and Iraq conflicts, 2001–2017. *JAMA Surg.* 2019;154:600–8.
- Repine TB, Perkins JG, Kauvar DS, Blackburne L. The use of fresh whole blood in massive transfusion. *J Trauma.* 2006;60:S59–69.
- Spinella PC, Perkins JG, Grathwohl JG, Beekley AC, Holcomb JB. Warm fresh whole blood is independently associated with improved survival for patients with combat-related traumatic injuries. *J Trauma.* 2009;66:S69–76.
- Nessen SC, Eastridge BJ, Cronk D, Craig RM, Berséus O, Ellison R, et al. Fresh whole blood use by forward surgical teams in Afghanistan is associated with improved survival compared to component therapy without platelets. *Transfusion.* 2013;53(Suppl 1):107S–13S.
- Gurney J, Staudt A, Cap A, Shackelford S, Mann-Salinas E, Le T, et al. Improved survival in critically injured combat casualties treated with fresh whole blood by forward surgical teams in Afghanistan. *Transfusion.* 2020;60(Suppl 3):S180–8.
- Shea SM, Staudt AM, Thomas KA, Schuerer D, Mielke JE, Folkerts D, et al. The use of low-titer group O whole blood is independently associated with improved survival compared to component therapy in adults with severe traumatic hemorrhage. *Transfusion.* 2020;60(Suppl 3):S2–9.
- Joint trauma system clinical practice guideline, Whole blood transfusion. 15 May 2018. [https://jts.amedd.army.mil/assets/docs/cpgs/JTS_Clinical_Practice_Guidelines_\(CPGs\)/Whole_Blood_Transfusion_15_May_2018_ID21.pdf](https://jts.amedd.army.mil/assets/docs/cpgs/JTS_Clinical_Practice_Guidelines_(CPGs)/Whole_Blood_Transfusion_15_May_2018_ID21.pdf). Accessed 12 Dec 2020.
- Cap AP, Beckett A, Benov A, Borgman M, Chen J, Corley JB, et al. Whole blood transfusion. *Mil Med.* 2018;183(Suppl 2):44–51.
- Kotwal RS, Montgomery HR, Miles EA, Conklin CC, Hall MT, SA MC. Leadership and a casualty response system for eliminating preventable death. *J Trauma Acute Care Surg.* 2017;82(6 Suppl 1):S9–S15.
- Stranden G, Skogrand H, Spinella PC, Hervig T, Rein EB. Donor performance of combat readiness skills of special forces soldiers are maintained immediately after whole blood donation: a study to support the development of a prehospital fresh whole blood transfusion program. *Transfusion.* 2013;53:526–30.
- Eliassen HS, Hervig T, Backlund S, Sivertsen J, Iversen VV, Kristoffersen M, et al. Immediate effects of blood donation on physical and cognitive performance—a randomized controlled double-blinded trial. *J Trauma Acute Care Surg.* 2018;84(6S Suppl 1):S125–31.
- Eliassen HS, Aandstad A, Bjerkvig C, Fosse T, Hervig TA, Pidcoke HF, et al. Making whole blood available in austere medical environments: donor performance and safety. *Transfusion.* 2016;56(Suppl 2):S166–72.
- Tactical combat casualty care guidelines. 5 Nov 2020. <https://deployedmedicine.com/market/11/content/40>. Accessed 12 Dec 2020.

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