Use of Walking Blood Bank at Point of Injury During Combat Operations

A Case Report

Matthew Gaddy, NREMT-P1; Alan Fickling, ATP, NREMT-B2; Vanessa C. Hannick, MD2; Stacy Shackelford, MD4*

ABSTRACT

The US Military Tactical Combat Casualty Care guidelines recommend blood products as the preferred means of fluid resuscitation in trauma patients; however, most combat units do not receive blood products prior to executing combat operations. This is largely due to logistical limitations in both blood supply and transfusion equipment. Further, the vast majority of medics are not trained in transfusion protocol. For many medics, the logistical constraints for cold-stored blood products favor the use of Walking Blood Bank (WBB), however few cases have been reported of WBB implementation at the point of injury during real world combat operations. This case report reviews one case of successful transfusion using WBB procedures at point of injury during combat. It highlights not only the feasibility, but also the necessity, for implementation of this practice on a larger scale.

KEYWORDS: prehospital transfusion; fresh whole blood; walking blood bank

Introduction

Fresh whole blood (FWB) transfusion has been a practice of Special Operations Forces (SOF) medicine since World War I, however most accounts of its use are anecdotal or historical.14-19 Whole blood was actually the mainstay of resuscitation of trauma patients up until the Vietnam conflict, when crystalloid and component therapy became more common despite a lack of evidence to support this transition.5-7 In recent years, the benefits of FWB transfusion over blood component, crystalloid, or colloid fluid therapy have been demonstrated in deployed surgical settings for hypovolemic trauma patients.8-10 Additionally, blood transfusion has been shown to be associated with improved survival only when initiated within about 30 minutes of injury.11

Published cases of military prehospital FWB transfusion demonstrate the Walking Blood Bank (WBB) capability not at point of injury, but rather at the initial aid station.12,13 The sparse documentation of successful prehospital FWB transfusion has created concern over the procedure’s risks.

Recent US military combat experience as well as anticipated future scenarios highlight the need for early blood transfusion in austere and hostile settings prior to surgical team handoff.14-20

Case Presentation

A Special Forces Operational Detachment Alpha (SFODA) executed a night raid in the southwestern region of Afghanistan in 2018. The medics on the ground consisted of a US Army Special Operations Medical sergeant (18D), a combat medic (68W), and a US Air Force pararescueman (PJ).

At 2315L, one of the ground maneuver elements moved to breach a compound of interest when a barricaded shooter engaged the ground forces. This initial volley of fire resulted in two partner forces Afghanistan commando casualties. The casualties were dragged away from the breach location and into a makeshift casualty collection point (CCP). At the same time, an enemy fighter threw a grenade inside the compound resulting in an additional casualty. The assault force and medics consolidated the three patients into a hasty CCP near the compound of interest and began initial assessments. Initial triage revealed two critically wounded patients, including the patient of interest (patient A) and one walking wounded.

Patient A's initial assessment revealed two penetrating gunshot wounds (GSWs): one to the superior right thigh with a presumed exit wound on the left lower back, and the second to the anterior left chest with a presumed exit on the superior aspect of the left posterior thorax at approximately the angle of the scapula. Patient A initially presented with Glasgow Coma Scale (GCS) scale of 14 with spontaneous eye opening, spontaneous verbal response, and localized pain. Radial pulses were strong and equal. External hemorrhage control was addressed first. The initial hemorrhage control attempt for the thigh wound consisted of a combat application tourniquet (C-A-T); however, the wound was too proximal for effective tourniquet application and hemostasis. The decision was then made to use a size 12 XStat (RevMed, https://www.revmedx.com/xstat/) syringe to inject hemostatic impregnated pellets into the wound cavity, and this intervention proved effective for achieving hemostasis. Afterward, the tourniquet was unfurled and left in place. A pressure dressing was then applied to the thigh wound and the 68W arrived and began applying occlusive dressings to the thoracic wounds.

After initial treatment, the ground force moved patient A to a safer CCP 400 meters away. Movement was complicated by danger close air strikes along with stream crossings while...
carrying the litter. At 2330, Patient A arrived at the second CCP and was reassessed. Vital signs revealed a decreased GCS score of 12, as the patient began sounding confused and eye opening was to speech only, radial pulses were weak and oxygen saturation was 89% on ambient air. Given the hypoxemia and known thoracic wound, a left needle thoracostomy was performed and hemorrhage control reassessed, which revealed a slow oozing at the superior right thigh wound. The team leader called for medical evacuation (MEDEVAC) while humeral and sternal intraosseous (IO) lines and an 18-gauge intravascular line were placed. The team leader initially informed the medics that there were 8 minutes until exfiltration, therefore vascular access was secured and the patient was packaged for transport.

After the patient was packaged for evacuation, the team leader discovered that the joint operations center had not received the nine-line MEDEVAC request. This meant there was at least 20 more minutes until exfiltration. At this point, patient A had a GCS of 11 and intermittent spontaneous respirations despite repeat bilateral needle decompression and was being supported with intermittent assisted ventilations. Radial pulses continued to be weak and thready. Due to the patient’s deterioration, which was assessed to be most likely due to hemorrhage, the decision was made to initiate FWB transfusion.

Transfusion Procedure
At approximately 0010, one medic was assigned to confirm patient A’s blood type and recruit suitable donors while another medic administered tranexamic acid (TXA) via humeral IO. Once a suitable donor was identified, the blood types of both donor and recipient were confirmed using their respective blood identification cards. Due to tactical constraints, including restricted illumination and ongoing enemy presence, an Eldon Card (Eldon Biological A/S, https://www.eldoncard.com/) test was not performed. However, it should be emphasized that premission donor screening and issuance of blood donor cards to both US military and Afghan partner forces, were enforced and the donor procedure rehearsed. The standard procedure was to use a type-specific donor and confirm blood type of both donor and recipient using the issued blood donor cards. The medic responsible to draw blood utilized a Fenwal Single Collection Blood-Pack Unit (McKesson, https://mms.mckesson/product/581929/Fenwal-4R3611) for the donor, as described in the Advanced Tactical Paramedic Protocols Handbook. At 0016, FWB transfusion to patient A was flowing via sternal IO. Eight minutes later, half of the unit had been administered and MEDEVAC assets were on the ground. After administration of the half unit, vital signs had improved, respirations were back to 10–12 per minute with an improved pulse of 90 beats per minute (bpm). The team loaded patient A into the helicopter, conducted hasty handover, and continued with the mission.

Follow-on Care
The patient underwent a 12-minute MEDEVAC flight from point of injury to role 2 with attached forward surgical team (FST). During the flight, he was hypotensive with blood pressure estimated to be 60 mmHg by palpation with a heart rate of 90 bpm and an oxygen saturation of 72% on ambient air. The blood transfusion was completed, and he underwent an additional needle decompression prior to arriving at the FST location. On FST arrival, his blood pressure was 124/80 and heart rate 115 bpm. He was noted to have penetrating wounds of the left upper quadrant of the abdomen, left flank and two wounds to the right upper thigh; a focused assessment with sonography for trauma (FAST) was positive for abdominal fluid. He immediately underwent exploratory laparotomy where he was found to have injuries to the spleen (grade 5), colon, and left hemidiaphragm necessitating splenectomy, partial colonic resection, washout of the left thorax, diaphragm repair, and temporary abdominal closure. He received 6 units red blood cells (RBCs) and 4 units fresh frozen plasma (FFP). After initial damage control surgery, he remained intubated and sedated and underwent an uneventful 1.5-hour transfer flight to the role 3 hospital.

On role 3 arrival, his blood pressure had improved to 135/71 with heart rate of 95 bpm. He was taken to the operating room where he underwent re-exploration of the abdomen, washout of the left chest, colon anastomosis, diaphragm repair, abdominal closure as well as right groin exploration and removal of X-stat sponges. He received an additional 1 unit pRBCs, 2 units fresh frozen plasma (FFP), and 1 unit apheresis platelets. He required ongoing wound and respiratory care, drainage of pleural and left upper quadrant fluid collections, and gradually improved. He was discharged from the role 3 after 18 days.

Discussion
Hemorrhage is the leading cause of mortality from potentially survivable injuries on the battlefield, and most of these injuries are truncal (67.3%) followed by junctional (19.2%) and peripheral extremity (13.5%). Even with advances in junctional hemorrhage control techniques, truncal hemorrhage control cannot be accomplished on the battlefield. Improving survivability on the battlefield requires managing the critically wounded using alternative techniques until they can reach a surgical capability.

United States military data support that prehospital blood product transfusion within about 30 minutes of injury improves survival from combat trauma. This capability was initially implemented on MEDEVAC platforms in 2012, and then expanded to Special Operations medics for use at the point of injury beginning in 2014. The Ranger Regiment first implemented the capability for WBB procedures and FWB transfusion. However, as the capability to carry cold-stored, universal donor low-titer group O whole blood (LTOWB) was successfully advanced, the implementation of WBB during real-world combat operations became a backup plan with questionable feasibility that has only rarely been executed. However, a WBB FWB approach offers some advantages over cold-stored blood as it requires fewer items and less weight for the medic to carry and avoids the logistical challenges and extensive blood product wastage inherent to the use of cold-stored products (Figure 1). Additionally, FWB is associated with a survival advantage compared to blood component therapy.

Currently there is a disparity between US military Special Operations and conventional forces for prehospital transfusion capability. Conventional units seeking to implement prehospital transfusion are faced with a limited supply of LTOWB as well as a formidable cost to purchase ruck-portable blood storage solutions and hand-held blood warmers for all medics. Due to such barriers, many units are investigating the feasibility of
implementing a WBB capability for combat medics. Such a capability is labor intensive in terms of prescreening donors as well as training and skill sustainment of medics; however, the WBB solution may be more achievable than cold-stored products for widespread implementation across the Force.

An argument against WB field transfusions is the possibility of transmission reaction and transmitted disease. The most lethal transfusion reaction is a blood type mismatch, which is potentially fatal, albeit rare. Type-specific transfusions carry the risk of type mismatch, particularly in multicasualty situations, and should be utilized only in dire circumstances when group O donors are depleted. Current military prehospital guidelines specify the use of group O donors for all, preferably confirmed low titer. Rh match is not necessary. Transfusion protocols give medics protocol-based steps for treating transfusion reactions, however transfusion reaction is difficult to differentiate from hemorrhagic shock and is rarely diagnosed. In the circumstance in which a field WB transfusion is performed, the risk of death from hemorrhage far outweighs the rare possibility of transfusion reaction or disease transmission.

Tactical considerations also must come into play when discussing prehospital transfusion. The standard equipment load of a SOF medic is variable depending on the mission set. In current operations, more often than not, SOF medics execute raids in which equipment must be as light and streamlined as possible. The supplies required for safe execution of FWB transfusion, as demonstrated in this case, are minimal and include only the collection bag, one pair of hemostats, scissors, appropriate lab materials, and standard resuscitation materials universally carried by combat medics (Table 1). The additional WBB supplies add no more than 18 ounces, versus the average 60 ounces required to carry cold-stored WB in the proper container along with a warming unit.

In the case presented, the entire procedure from start of donor draw to end of recipient transfusion spanned 15 minutes. Only one unit was transfused prior to role 2 arrival, along with external hemorrhage control. Both helped stabilize the casualty’s condition. 

---

**FIGURE 1** Blood transfusion.
vital signs. With proper training and familiarization, the ability to execute the WBB procedure rapidly and safely is practical, especially when donors’ blood types are preidentified. Transfusion of relatively small volumes of a warm, fresh whole blood product provides an optimal resuscitation intervention to bleeding casualties and may bridge casualties to evacuation and damage control surgery. This is especially relevant in cases where hemorrhage control can be achieved with prehospital interventions.

Conclusion

Uncontrolled hemorrhage prior to reaching damage control surgical care contributes disproportionately to battlefield mortality. Resuscitation from hemorrhagic shock requires blood products, however there are significant logistic barriers to carrying cold-stored blood products to the point of injury. The WBB capability is a lightweight and rapid method to provide medics with FWB, enable early resuscitation, and improve survival from severe traumatic injury. This capability should be expanded to all military medics, and medic training must include WBB with goal-directed tactical damage control resuscitation. These skills should be considered standard for all combat medics across the Department of Defense (DoD).

Disclosures

The authors declare that they have no competing interests.

Disclaimer

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. Public affairs office and operational security reviews were conducted by the Defense Health Agency.

Authorship Contributions

MG and AF conducted the mission and collected the documentation. MG and VH drafted the manuscript. SS provided the role 2 and 3 follow-up, reviewed all documentation and edited the manuscript. All authors read and approved the final manuscript.

References


Inside this Issue:

- FEATURE ARTICLES: Prehospital Blood Transfusion
- Processionary Caterpillar as Threat in Australia
- Helicopter Simulation Video Laryngoscope
- Loading Patterns in Military Personnel With Back Pain
- Stress Inoculation Training: A Performance Training Protocol, Part 1 and Part 2
- Ultrasound for Special Operations Medics
- Hemostatic Dressings in an Extended Field Care Model ➔ EMS Providers Having Firearms
- Anesthesia Gas Machines During Coronavirus Pandemic
- Swine Polytrauma Model Without Fluid Resuscitation
- Overview of the Combat Medical Care (CMC) Conference 2021 ➔ Combat Medical Care Conference 2021 Abstracts
- CASE REPORTS: Prehospital Iliac Crest IO Whole Blood Infusion
- Walking Blood Bank at Point of Injury ➔ CASEVAC Case Series in Austere Environment
- ONGOING SERIES: Infectious Diseases, Injury Prevention, Snakebite Envenomation Management, There I Was, TCCC Updates, and more!

Dedicated to the Indomitable Spirit, Lessons Learned & Sacrifices of the SOF Medic