PREHOSPITAL
BLOOD TRANSFUSION
COALITION

Prehospital Blood Transfusion Coalition Clinical Practice Guideline for Civilian Emergency Medical Services

PURPOSE

This Clinical Practice Guideline (CPG) provides essential instructions for prehospital blood product transfusion in civilian Emergency Medical Services (EMS) systems. This guideline supports early resuscitation with blood products for patients experiencing hemorrhagic shock, regardless of etiology, with the objective of reducing mortality and improving clinical outcomes. Implementation of a prehospital blood transfusion program requires careful planning, appropriate training, quality control measures, adherence to regulations, close physician medical oversight, and coordination with regional blood suppliers and receiving facilities.

INTRODUCTION

Early administration of blood products to patients experiencing hemorrhagic shock, irrespective of etiology, has been demonstrated to improve survival. Research indicates that patients who receive blood products within the initial minutes after injury or onset of hemorrhagic shock exhibit significantly decreased mortality compared with those who receive delayed transfusion. Prehospital transfusion programs are, by their nature, resuscitation programs intended for patients with clear evidence of hemorrhagic shock.

This CPG represents a living document intended to outline the indications, procedures, equipment, and monitoring required to safely administer blood products in the prehospital setting. It is based on current evidence and best practices and is expected to evolve as the body of evidence expands. Blood products encompass therapeutic substances derived from human blood, including components such as red blood cells, plasma, platelets, and whole blood, which are considered safe and effective treatments for hemorrhagic hemodynamically unstable patients.

Effective team communication and coordination constitute the cornerstone of successful resuscitation from hemorrhagic shock. Team members are often tasked with multiple urgent interventions occurring in parallel; therefore, effective communication is essential to ensure positive patient outcomes and prevent adverse effects. Structured handoffs between prehospital clinicians and hospital resuscitation teams are essential to ensure that relevant information is conveyed without delaying critical interventions. EMS systems seeking to implement prehospital blood transfusion are encouraged to implement standardized team communication and structured handoff procedures to enhance patient care continuity from the prehospital environment to definitive care.

These guidelines should be implemented in concert with local medical oversight and are not intended to supersede local protocols or medical direction. Successful prehospital blood programs must be thoughtfully planned, incorporate multiple safeguards, ensure adequate training and credentialing processes, and involve responsible stewardship of

blood resources. Implementation requires clear indications for transfusion, both clinical and programmatic accountability, and appropriate documentation procedures.

PREHOSPITAL PRINCIPLES OF RESUSCITATION AND TRANSFUSION

1. **Rapid Recognition** of life-threatening hemorrhagic shock
    - Clinical assessment remains the cornerstone for recognition, including physiological parameters such as vital signs, shock index, end-tidal CO_2 ($ETCO_2$), and others
    - Consider point-of-care devices if available, such as lactate measurement
2. **Hemorrhage Control** with appropriate adjuncts:
    - Pressure dressings and wound packing (preferably with hemostatic products) for severe wounds
    - Tourniquets for significant extremity hemorrhage
    - Pelvic binders for suspected pelvic fractures
    - Wound packing or junctional tourniquets for junctional hemorrhage
3. **Hemostatic Resuscitation**
    - Whole blood (WB) when available:
        - Low-titer O whole blood (LTOWB), or
        - Plasma, or
        - Packed red blood cells (PRBCs)
            - Aim for balanced 1:1 ratio of plasma to RBCs when possible

4. **Minimize Crystalloid Use**
    - Limit crystalloid resuscitation to less than 500 mL
    - Excessive crystalloid worsens coagulopathy and contributes to hemodilution
5. **Prevent Hypothermia**
    - Utilize appropriate warming devices for blood products
    - Maintain patient temperature with passive warming measures
    - Consider active warming devices when available
6. **TXA Administration**
    - For patients who will receive blood and are within 3 hours of injury
    - Adult dose:
        - 2 grams intravenous/intraosseous (IV/IO) once, or
        - 1 gram IV/IO over 10 minutes, followed by 1 gram over 8 hours
    - Pediatric dose:
        - 15 mg/kg (maximum 1 gram) IV over 10 minutes
7. **Calcium Replacement**
    - Consider calcium IV after 2 units of blood products have been administered and after other hemostatic interventions are completed
        - Calcium Gluconate 3 grams (less caustic to tissue), or
        - Calcium Chloride 1 gram
        - Monitor for signs of hypercalcemia
    - Pediatric dose:

        - 60 mg/kg calcium gluconate, or
        - 20 mg/kg calcium chloride
    - Flush the line with 10 mL of saline
    - Monitor closely for signs of IV/IO infiltration/extravasation

CRITERIA FOR TRANSFUSION [Table 1]

Clinical Indications

Suspected hemorrhagic shock from trauma or medical cause:

Adults:

- Systolic blood pressure (SBP) less than 90 mmHg or weak or absent radial pulse, or
- Heart Rate (HR) greater than 100 bpm unresponsive to initial interventions, or
- Shock Index (HR/SBP) greater than 1.0

Pediatrics:

- Systolic BP less than 70 + (Age in years × 2)
- Heart Rate:
    - 1 year: greater than 190
    - 2-10 years: greater than 140

AND

One or more of the following physiologic criteria indicative of hypoperfusion:

- Altered mental status (not believed to be due to intoxication or head injury)
- Pale, cool, clammy skin; pale mucosa
- Delayed capillary refill (> 2 seconds)
- Tachypnea
- $ETCO_2$ < 25 mmHg

Examples of Patient Presentations Consistent with Suspected Hemorrhagic Shock Necessitating Prehospital Blood Transfusion

Trauma patients with uncontrolled hemorrhage:

- Any proximal amputation above knee/elbow or amputations requiring a tourniquet
- Penetrating trauma to neck/chest/abdomen/pelvis with signs of shock
- Evidence of significant blood loss (> 500 mL estimated)
- Unstable pelvic fracture with hemodynamic instability

Medical patients with significant hemorrhage:

- Gastrointestinal bleeding
- Ruptured ectopic pregnancy

- Peripartum hemorrhage
- Ruptured aortic (thoracic or abdominal) aneurysm
- Ruptured AV fistulas/grafts
- Postsurgical complications
- Epistaxis
- Post-tonsillectomy bleeding
- Other causes of significant blood loss

Special Populations

Patients with known bleeding disorders who are in hemorrhagic shock:

- Resuscitation priority should be given to the administration of blood products first, followed by appropriate treatment for the specific bleeding disorder

Pregnant Patients:

- Consider early blood administration for suspected obstetric or postpartum hemorrhage with signs of hemorrhagic shock
- Place in left-lateral recumbent position (left side down)
- When O-positive blood is administered to females of childbearing potential, ensure that it is communicated to the receiving attending physician that Rhesus Factor positive (Rh+) blood was transfused

Special Considerations

- If O-positive blood is administered to Rh-negative females of childbearing potential, inform receiving facility for potential post-discharge consultation with hospital Transfusion Services and maternal-fetal medicine
    - Additional information and resources can be found at https://allohopefoundation.org
- There is no role for the administration of RhoGAM in the acute resuscitation of hemorrhagic shock

EQUIPMENT REQUIREMENTS [Table 2]

1. FDA-approved blood storage container/cooler validated for prehospital use
2. Temperature monitoring devices with local alarms, as well as remote tracking and audit capabilities consistent with established requirements
3. Blood administration sets with 170-260-micron filter
4. Blood warming devices
5. Rapid infusion devices
6. Large-bore IV/IO access equipment
7. Vital signs monitoring equipment

PROCEDURE

Preparation and Storage

1. Maintain blood products in approved storage containers between 1-6°C or as outlined in the agency Blood Services Agreement
2. Monitor and document temperature continuously
3. Inspect blood products for:
    - Expiration date
    - Integrity of the bag
    - Evidence of hemolysis, clotting, or contamination
    - Temperature indicator compliance

Adult Dosing Guidance

- Initial dose: 1 unit of any blood product
- Reassess vital signs and clinical response every 3 minutes and after each unit
    - As with all medications, monitoring the response to blood products needs to be performed continuously done. While there is a small risk of over-resuscitation with a multiple units of prehospital blood products being transfused, this risk can be mitigated by re-assessment of vital signs and the patient's physiologic response.
- Administer additional units as indicated

- Target SBP 90-100 mmHg (permissive hypotension) for hemorrhagic shock from trauma or obstetric/medical conditions
- Target higher SBP (>110 mmHg) for patients with traumatic brain injury (TBI) or suspected neurological injury

Pediatric Dosing Guidance

- Initial dose:
    - <35 kg: 10 mL/kg of unit of any blood product
    - >35 kg: 1 unit of any blood product
- Reassess vital signs and clinical response after each unit
- Additional units based on clinical response and transport time
- Target age-appropriate SBP for hemorrhagic shock from trauma or obstetric/medical conditions
- Target higher SBP (>110 mmHg) for patients with TBI or suspected neurological injury

Transfusion Process [Table 3]

1. Obtain preferably two points of IV/IO access (18 gauge or larger preferred)
2. Quickly assess for any indicators that the patient would not want to receive blood products (verbal religious preference, medical alert tag, wallet card)
    - This should not delay patient care

3. Verify and document blood product identification:
    - Product type
    - Unit/donor number
    - Expiration date
    - Blood type
    - Temperature indicator status (if present)
4. Connect administration set with appropriate filter to blood product
5. Prime straight-type blood tubing with blood (no saline) or
6. Prime Y-type blood tubing with saline
7. Connect to warming device and/or rapid infusion device
8. Connect the blood tubing directly to the IV/IO hub. Do not connect the blood through an extension set that is smaller in diameter than the blood tubing. For IO access, if using manufacturer-provided 90-degree angle extension, consider removal to facilitate easier flow
9. Infuse over 3-5 minutes as clinically indicated
10. Monitor vital signs every 5 minutes during transfusion (before, during, and after transfusion):
    - Blood pressure
    - Heart rate
    - Respiratory rate
    - Oxygen saturation
    - $ETCO_2$

- Temperature when possible

11. Document vital signs before, during, and after transfusion
12. Monitor for signs of transfusion reaction

TRANSFUSION REACTIONS

Signs and Symptoms

Acute anaphylactic reaction:

- Hypotension or hypertension
- Flushed face, urticaria, or rash
- Wheezing or respiratory distress
- Fever or chills
- Flank pain
- Chest pain or back pain
- Nausea/vomiting

Management

1. Stop transfusion immediately
2. Maintain IV access to keep the line open
3. Administer oxygen as needed
4. For anaphylaxis:

- Epinephrine 0.3-0.5 mg of 1:1000 intramuscular (IM)
- Diphenhydramine 25-50 mg IV/IO/IM
- Consider methylprednisolone 125 mg IV for severe reactions

5. Notify receiving facility of suspected transfusion reaction
6. Transport all blood product bags/documentation to hospital

DOCUMENTATION REQUIREMENTS

1. **Blood products are documented as a medication**
2. **Every transfusion should have 2 procedures listed:**
   - 1. Route (IV/IO)
   - 2. Transfusion of blood products
3. Blood product information:
   - Type of blood product
   - Unit/donor number
   - Expiration date
   - Time of removal from storage
   - Temperature status during storage and transport
4. Transfusion details:
   - Time transfusion started and completed
   - Total volume transfused
   - Route of administration

- Post-transfusion physician authorization statement with signature (See Appendix A)

5. Patient assessment:
    - Verification of consent (verbal or implied)
    - Vital signs pre-transfusion, during (every 3 minutes), and post-transfusion
    - Clinical presentation and indication for transfusion
    - Patient response to transfusion
6. Additional interventions:
    - Hemorrhage control
    - Calcium administration
    - TXA administration
    - Other medications or interventions
7. Adverse events:
    - Description of any reaction
    - Interventions performed
    - Patient response
8. Handoff information:
    - Notification to receiving facility
    - Blood product bag(s) with segments attached
    - Transfusion-related paperwork
    - Disposition of unused blood products

QUALITY CONTROL MEASURES

1. Storage and transport:
    - Continuous temperature monitoring with documentation
    - Regular inspection of storage containers
    - Proper handling procedures
2. Equipment maintenance:
    - Regular checks of administration equipment
    - Calibration of warming devices, if needed
3. Personnel:
    - Initial and ongoing training
    - Skills verification for all providers
    - Competency-based assessment annually
4. Program management:
    - Case review of all prehospital transfusions (consider as Sentinel Event)
    - Tracking of clinical outcomes (See Appendix B)
    - Regular reporting to medical director
    - Blood product utilization analysis
    - Wastage monitoring and reduction strategies

TRAINING REQUIREMENTS

1. Initial training:
    - Pathophysiology of hemorrhagic shock
    - Blood product overview and indications
    - Recognition of hemorrhagic shock
    - Transfusion procedures and equipment
    - Recognition and management of transfusion reactions
    - Storage and transport requirements
    - Documentation requirements
    - Practical skills demonstration
2. Continuing education:
    - Annual refresher training
    - Regular skills verification and simulation
    - Case reviews and lessons learned
    - Updates to protocols or equipment
3. Competency validation:
    - Written examination
    - Practical skills assessment
    - Simulation scenarios
    - Clinical oversight during initial cases

PROGRAM IMPLEMENTATION CONSIDERATIONS

1. Training and Education:
    - Initial didactic training
    - Hands-on skills practice and sign-off
    - Simulation and case-based training
    - Ongoing demonstration of procedural competency and skills currency
2. Medical oversight:
    - Transfusion Administration Service (TAS) Medical Director shall have authority and responsibility for all medical and technical policies, processes, and procedures that relate to the care and safety of the transfusion recipient
    - Regular protocol review and updates
    - Credentialing of all personnel who are authorized to administer prehospital blood
    - 100% total quality review on every prehospital transfusion case
    - Reporting and follow-up of transfusion-related adverse events
3. Blood product management:
    - Coordination with blood suppliers
    - Storage and transport requirements
    - Rotation protocols to minimize wastage
    - Documentation requirements

- Return policies for unused products

4. Hospital coordination:
    - Communication protocols with receiving facilities including the hospital blood bank
    - Handoff procedures for transfused patients
    - Handoff procedures for blood products
    - Tracking of patient outcomes
5. Infrastructure requirements:
    - Proper storage facilities
    - Temperature monitoring systems
    - Administration equipment
6. Administrative considerations:
    - Costs and billing procedures
    - Legal and regulatory compliance
    - Documentation systems
    - Data collection for quality improvement
    - Outcomes reporting, registry participation

REFERENCES

1. Shackelford SA, Del Junco DJ, Powell-Dunford N, 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(16):1581-1591.

2. Sperry JL, Guyette FX, Brown JB, et al. Prehospital plasma during air medical transport in trauma patients at risk for hemorrhagic shock. N Engl J Med. 2018;379(4):315-326.
3. Guyette FX, Sperry JL, Peitzman AB, et al. Prehospital blood product and crystalloid resuscitation in the severely injured patient: a secondary analysis of the Prehospital Air Medical Plasma trial. Ann Surg. 2021;273(2):358-364.
4. Holcomb JB, Tilley BC, Baraniuk S, et al. Transfusion of plasma, platelets, and red blood cells in a 1:1:1 vs a 1:1:2 ratio and mortality in patients with severe trauma: the PROPPR randomized clinical trial. JAMA. 2015;313(5):471-482.
5. Yazer MH, Spinella PC, Bank EA, et al. THOR-AABB working party recommendations for a prehospital blood product transfusion program. Prehosp Emerg Care. 2022;26(6):863-875.
6. Levy MJ, Garfinkel EM, May R, et al. Implementation of a prehospital whole blood program: Lessons learned. JACEP Open. 2024;5:e13142.
7. Schaefer RM, Bank EA, Krohmer JR, et al. Removing the barriers to prehospital blood: A roadmap to success. J Trauma Acute Care Surg. 2024;97:S138-S144.
8. Bulger EM, Perina DG, Qasim Z, et al. Clinical use of resuscitative endovascular balloon occlusion of the aorta (REBOA) in civilian trauma systems in the USA, 2019: a joint statement from the American College of Surgeons Committee on Trauma, the American College of Emergency Physicians, the National Association of Emergency Medical Services Physicians and the National Association of Emergency Medical Technicians. Trauma Surg Acute Care Open. 2019;4(1):e000376.

9. Ho KM, Leonard AD. Concentration-dependent effect of hypocalcaemia on mortality of patients with critical bleeding requiring massive transfusion: a cohort study. Anaesth Intensive Care. 2011;39(1):46-54.
10. McGinity AC, Zhu CS, Greebon L, et al. Prehospital low-titer cold-stored whole blood: Philosophy for ubiquitous utilization of O-positive product for emergency use in hemorrhage due to injury. J Trauma Acute Care Surg. 2018;84(6S Suppl 1):S115-S119.
11. Newberry R, Winckler CJ, Luellwitz R, et al. Prehospital transfusion of low-titer O+ whole blood for severe maternal hemorrhage: A case report. Prehosp Emerg Care. 2020;24(4):566-575.
12. Braverman MA, Smith AA, Ciaraglia AV, et al. The regional whole blood program in San Antonio, TX: A 3-year update on prehospital and in-hospital transfusion practices for traumatic and non-traumatic hemorrhage. Transfusion. 2022;62(Suppl 1):S80-S89.
13. Carico C, Annesi C, Mann NC, Levy MJ, Acharya P, Hurson T, Lammers D, Jansen JO, Kerby JD, Holcomb JB, Hashmi ZG. Nationwide trends in prehospital blood product use after injury 2020-2023. Transfusion. 2025 Apr 4.
14. Rajesh A, Schaefer RM, Krohmer JR, Bank EA, Holcomb JB, Jenkins DH. From shortages to solutions: Liquid plasma as a practical alternative to whole blood for prehospital trauma resuscitation. Transfusion. 2025 Apr 3.
15. Smith AA, Alkhateb R, Braverman M, et al. Efficacy and Safety of Whole Blood Transfusion in Non-Trauma Patients. Am Surg. Sep 30 2021.

16. Lammers DT, Betzold R, Henry R, Dilday J, Conner JR, Williams JM, McClellan JM, Eckert MJ, Jansen JO, Kerby J, Holcomb JB, Hashmi ZG. Nationwide estimates of potential lives saved with prehospital blood transfusions. Transfusion. 2025 Mar 10.
17. Brito AM, Yazer MH, Sperry JL, Luther JF, Wisniewski SR, Guyette F, Moore EE, Cotton BA, Vincent L, Fox E, Cannon JW, Namias N, Minei JP, Ammons LA, Clayton S, Schreiber M. Evolution of whole blood trauma resuscitation in childbearing age females: practice patterns and trends. Trauma Surg Acute Care Open. 2024 Dec 7;9(1):e001587.
18. Crowe EP, Frank SM, Levy MJ. Mitigating the risk of low-titer group O-positive whole blood resuscitation in females of childbearing potential: toward a systems-based approach. Trauma Surg Acute Care Open. 2024 Dec 15;9(1):e001687.
19. Clayton S, Tremoglie-Barkowski M, Leeper CM, Lu L, Brown J, Spinella PC. Sex-based disparities in low-titer O whole blood utilization and mortality among severely injured trauma patients. Transfusion. 2025 Apr 10.
20. Brown JB, Yazer MH, Kelly J, Spinella PC, DeMaio V, Fisher AD, Cap AP, Winckler CJ, Beltran G, Martin-Gill C, Guyette FX. Prehospital Trauma Compendium: Transfusion of Blood Products in Trauma - A Position Statement and Resource Document of NAEMSP. Prehosp Emerg Care. 2025 Apr 1:1-10.
21. Standards for Emergency Prehospital and Scheduled Out-of-Hospital Transfusions. https://www.aabb.org/standards-accreditation/standards/standards-for-emergency-prehospital-and-scheduled-out-of-hospital-transfusions

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Figures and Tables

Table 1: Clinical Indicators of Hemorrhagic Shock

Clinical Indicator	Description
Hypotension	Systolic BP <90 mmHg
Tachycardia	Heart rate >100 bpm; unresponsive to initial interventions
Respirations	Rapid/shallow respirations
Pulse quality	Weak, thready pulse
Capillary Refill	>2 seconds
Mental status	Decreased (excluding head injury and/or intoxication)
$ETCO_2$	<25 mmHg
Skin	Pale, cool, clammy
Bleeding	Active hemorrhage from non-compressible source
Shock Index	>1.0 (Heart rate/systolic BP)

Table 2: Blood Product Cold Chain Storage Requirements

Parameter	Requirement
Temperature	1-6°C (33.8-42.8°F) (storage) 1-10°C (transport)
Monitoring	Continuous with audible alarm capability
Documentation	Temperature log maintained
Container	Validated by blood supplier
Maximum time outside controlled storage	4 hours for transfusion
Maximum time in an approved, locally validated cooler	Per cooler (typically 24-48 hours)

Table 3: Prehospital Blood Transfusion Procedure Checklist

BEFORE TRANSFUSION:

[ ] Confirm indication for transfusion meets criteria

[ ] Quickly assess for indicators that the patient would not want to receive blood (verbal consent if possible, medical alert tag, wallet card)

[ ] Establish adequate IV/IO access (ideally 2 points of access)

[ ] Obtain and record baseline vital signs

[ ] Verify blood product unit information and expiration

[ ] Check temperature indicator on blood bag (if present)

[ ] Inspect blood product for abnormalities

[ ] Prepare administration set with appropriate filter

DURING TRANSFUSION:

[ ] Monitor vital signs every 5 minutes before, during, and after transfusion

[ ] Watch for signs of transfusion reaction

[ ] Document time transfusion started

AFTER TRANSFUSION:

[ ] Record post-transfusion vital signs

[ ] Document time transfusion completed

[ ] Document total volume infused

[ ] Notify receiving facility of blood administration

[ ] Transport all blood product bags to hospital

[ ] Complete all required documentation

[ ] Return unused products according to protocol

QUALITY MANAGEMENT:

[ ] Maintain detailed records of all blood products deployed in the field including daily check-off procedures

[ ] Have a local database of all prehospital blood cases to track administration and patient outcomes

[ ] Immediate post-transfusion hot-wash with EMS clinicians

[ ] Review case in detail: Indications, procedure, documentation, outcomes

[ ] Ensure that a prescriber's authorization note is attached/uploaded to the prehospital chart

Appendix A: Physician Authorization Form Documentation Guidance

The electronic patient care record (ePCR) shall contain a physician-signed statement indicating that the clinical situation was sufficiently urgent to require release of uncrossmatched emergency-released blood before completion of compatibility testing.

The TAS medical director signature may occur before or after the release/transfusion of the blood, as defined by local, state, federal, or Competent Authority regulations.*

*21 CFR 606.160(b)(3)(v) and 21 CFR 606.151(e)

Sample Verbiage:

"Physician statement for Emergency Blood Release: Due to the life-threatening emergency, and since the situation is such that the risk to the patient of a transfusion reaction from receiving uncrossmatched emergency-released blood is less than the risk of continued blood loss without replacement"

Appendix B: Quality Improvement Tracking Tool

Sample List of Metrics for Tracking:

- Incident Date (date)
- EMS Incident # (number)
- Hospital MRN (number)

- Date EMS case reviewed (date)
- Authorization form attached to chart? (Y/N)
- Administering EMS clinician (name/ID number)
- Destination (hospital name)
- Blood Product Type (by HCPCS code) (number)
- Age (number)
- Sex at birth (male/female)
- Etiology (Medical/Trauma)
- Estimated Blood Loss (mL)
- Mechanism/Nature (free text)
- Nadir Field BP (number)
- Proximate BP
- EMS Shock Index (number)
- Highest EMS HR (number)

- Proximate HR
- Shock Index after first unit (number)
- Total Units of blood product given (number)
- Additional blood in ED (number)
- Initial iCal at hospital (number)
- Nadir Hgb (number)
- Patient's confirmed blood type (ABO status)
- Antibodies present
- Prehospital Cardiac Arrest/Circulatory Collapse (Y/N)
- Alive upon hospital arrival (Y/N)
- Alive at 6 hours (Y/N)
- Alive at 24 hours (Y/N)
- Initial Disposition (Admitted, Discharged, Deceased)
- Notes (free text)
- Final Disposition (Discharge location/type)