Carroll County Department of Fire & EMS
Standard Operating Procedure

DOCUMENT DETAILS

Standard Operating Procedure: 3.48	**Effective Date: TBA**
Subject: LTO+ Whole Blood Program	**Section: Emergency Medical Services**
Authorized: Eric Zaney, Assistant Chief	**Revision Date: N/A**

Applicability: **[x] Volunteer** **[x] Career**

I. PURPOSE

The prehospital administration of whole blood has been shown to improve critically ill patients' survival and decrease the need for hospital blood product administration, thus helping conserve precious and limited blood resources. An increasing number of jurisdictions within the Maryland EMS system, and worldwide, have implemented prehospital whole blood programs. The Carroll County Department of Fire and Emergency Medical Services (CCDFEMS) is committed to providing our patients with the highest-quality emergency medical care through the implementation of evidence-based practices.

This SOP outlines CCDFEMS' prehospital whole blood program, including supply, storage, administration, and documentation. It is vital for our patients' safety and this program's sustainability that all personnel strictly adhere to the practices outlined in this document.

II. APPLICABILITY

This policy applies to CCDFEMS career and volunteer personnel with a valid Advanced Life Support (ALS) provider certification, and who have acquired the appropriate credentials to administer Whole Blood as outlined in this document

III. DEFINITIONS

Patient: Person directly receiving medical care from an EMS clinician.

Low Titer O+ Whole Blood (Whole blood/blood products): Type-O blood comprising of red blood cells, plasma, and platelets; contains low levels of antibodies generally considered safe for emergency transfusion, despite the patient's Rh factor.

Hemorrhagic Shock: Systemic hypoperfusion that occurs following blood loss.

Shock Index: A calculation to quantify the degree of shock. *Shock Index = Heart Rate / Systolic Blood Pressure*. Shock Index >1 is considered moderate shock and is associated with increased mortality rates.

Delta Ice 2L (Delta): Cold chain smart cooler that insulates a Temperature Control Insert (TCI) and is used to store Whole Blood.

Temperature Control Insert (TCI): The primary container that houses whole blood providing the required temperature range.

Excursion: Any recorded temperature of the cooler that falls out of 2℃ - 6℃ range.

Hemo-Trac: Blood temperature indicator attached by the blood bank onto the unit of blood.

LifeFlow Infuser (LifeFlow): Hand-operated rapid infuser used to administer fluids and blood products. It works by a standard push-pull mechanism with the mechanical advantage of a trigger. The LifeFlow delivers 10mL of fluid or blood when the trigger loop is fully depressed.

TEMPWATCH: A standalone temperature monitoring device that alerts when the conditioned Delta's Temperature Control Insert has reached its operating temperature during daily exchanges.

QinFlow Warrior Lite Fluid Warmer (QinFlow): A high-performance, compact warmer for fluids and blood products. The QinFlow can warm up to 180mL/min of frozen blood products to body temperature in a matter of seconds.

AABB: The American Association of Blood Banks.

Inova: Healthcare system in Northern Virginia and home to *Inova Blood Donor Services,* who provides our supply of blood products. They provide a courier to facilitate the exchange and replacement of blood products. Located at 45745 Nokes Boulevard, Suite 160, Sterling, VA 20165. Phone: 1-866-256-6372

MIEMSS: Maryland Institute for Emergency Medical Services Systems

Carroll County Public Safety Training Center (PSTC): Location of CCVESA and CCDFEMS representatives. Located at 50 Kate Wagner Road, Westminster, MD 21157.
CCVESA Phone: (410) 848-1488
CCDFEMS Phone: (410) 386-6812

Designations:

- **Chase Cars:** EMS101, EMS102, EMS103

- **Shift Commander:** OPS101 (410)-386-6823
- **Blood Program Manager:** Assistant Chief Eric Zaney. ezaney@carrollcountymd.gov
  Agency Medical Director: Dr. Stephanie Kemp. skemp@carrollcountymd.gov

IV. EQUIPMENT

A. **Blood Storage Equipment**

All blood shall be continuously housed in the Delta 2L cooler to maintain a storage temperature between 2º-6º Celsius per ABBA regulations. The blood shall only be removed immediately prior to transfusion to a patient, or when changing over TCIs. Only blood products shall be stored in the Delta bag. At no time shall food, drink, or other materials be stored in the TCI freezer or Delta.

The Delta shall be kept in an environment where the surrounding ambient temperature is maintained between 5-27°C (41-80F). The vehicle housing the Delta shall be parked in a temperature-controlled building between calls and locked to maintain security when left unattended.

B. **Blood Program Equipment**

1. **Critical Intervention Bag**
   a. The "critical intervention bag" shall contain all blood administration equipment, excluding the actual units of blood which shall be stored in a Delta 2L cooler. Additionally, this bag shall contain red patient bracelets indicating the administration of whole blood, a prefilled syringe of 10 % calcium chloride, equipment needed to administer TXA, and the necessary medications and equipment needed to treat a transfusion reaction. It also contains various guides for easy reference and troubleshooting during the blood administration procedure. This bag will be carried on the OPS101, EMS100, EMS101, EMS102, and EMS103 vehicles.

2. **Portable Cold Storage**
   a. One Delta 2L cooler containing a TCI shall be issued to EMS101, EMS102, and EMS103 units.
   b. The Delta cooler with TCI is certified to maintain temperatures between 2-6°C for at least 24 hours.
   c. The TCI shall be rotated promptly at the beginning of each shift (every 24 hours) with one that has been conditioning in the dedicated station freezer.
   d. The TCI in use should be completely frozen solid.
3. **TempWatch**
   a. A TempWatch mat will be issued to Station 4 (Manchester), Station 5 (Taneytown), and station 14 (Winfield).
   b. TempWatch is designed to interface with the Delta ICE TCI during conditioning to monitor the embedded temperature sensors and alert the user once the pack has reached 2-degree Celsius.
   c. During the morning changeover, the conditioned TCI will be removed from its respective freezer and placed on the TempWatch. Once ready, the old TCI will be removed from the Delta 2L cooler, the freshly conditioned one will be inserted along with the unit of blood, and the cooler will be closed. The safe temperature range for blood storage is between 2-6-degree Celsius.

4. **Dedicated TCI Freezers**
    a. A freezer will be issued to Station 4 (Manchester), Station 5 (Taneytown), and Station 14 (Winfield). An additional freezer will be located at the Public Safety Training Center (PSTC). These freezers will be utilized for the conditioning of the (Temperature control inserts) TCIs.
    b. Each freezer shall be plugged into an outlet that is generator-supported and set to a temperature of -14℃ or cooler.
    c. Each freezer shall have a thermometer for continuous temperature monitoring and validation.
    d. Each freezer shall have one TCI conditioning for at least 8 hours.
    e. If a freezer fails to maintain an appropriate temperature, the Shift Commander must be notified immediately.
    f. At no time should any units of whole blood be placed within the TCI freezer.

5. **Dedicated Whole Blood Refrigerator**
    a. A refrigerator will be located at the Public Safety Training Center (PSTC). This refrigerator will be utilized for the storage of whole blood units during exchanges and replacements with the Inova courier, and in the event of a Delta cooler failure such as the TCI becoming too warm prior to the secondary TCI being ready for replacement.
    b. This refrigerator shall be plugged into an outlet that is generator-supported and set to a temperature of 2-6℃.
    c. This refrigerator shall have a thermometer for continuous temperature monitoring and validation.
    d. If the refrigerator fails to maintain an appropriate temperature, the Shift Commander must be notified immediately.
    e. At no time shall the whole blood units be stored within the designated refrigerator for an extended period of time unless for any of the reasons indicated within this SOP.
    f. At no time shall food, drink or other materials be stored within this refrigerator.

6. **Wireless Temperature Monitoring**
    a. The Delta bag has an integrated temperature monitoring system for both internal and ambient temperature, which communicates wirelessly via cellular to the phones/iPads issued to each unit carrying blood products.
    b. Alarms are set for high (6℃) and low (2℃) ranges, with an audible alarm sounding on the device and notifications sent to all applicable devices when temperature thresholds are encountered.
    c. All temperature data is available through generated reports which cannot be altered or deleted.

7. **Pressure Infuser Bag**
    a. All blood products must be administered using a pressure infuser for adult patients when a LifeFlow device is not available.

8. **Specialized Filtered “Y” Tubing**
    a. This tubing is specifically designed for the administration of blood products.
    b. It is wider than regular IV tubing. It contains a specialized filter and a force reducer on the distal end to mitigate excessive pressure during infusion.

9. **LifeFlow Plus Volume Infuser**
    a. This is a hand-operated rapid infuser for precise volume delivery and shall be the primary device used for blood administration in all patients.

10. **QinFlow Warrior Lite Fluid Warmer**
    a. A QinFlow Warrior Lite Fluid Warmer will be issued to OPS101, EMS100, EMS101, EMS102, and EMS103 within the "critical intervention bag".
    b. It is comprised of the base unit, extension cable, battery, and a compact disposable unit (CDU) through which the blood products flow.

V. PROCEDURES

A. Authorization to Administer Whole Blood

Shift Commanders, Chase Car Clinicians, and those eligible to act in such roles who have completed the approved training program may administer whole blood to a patient who meets the criteria outlined in the Maryland EMS Protocols. The CCDFEMS whole blood training and credentialing process consists of successfully completing the following components:

1. Initial Credentialing for Authorized Advanced Life Support (ALS) Clinicians
    a. Online fundamentals of whole blood administration training modules completed via FireRescue1 Academy.
    b. In-person demonstration of blood product storage, administration, and documentation procedural skills.
    c. Evaluation of simulated resuscitation scenarios involving use of whole blood products.
    d. Written and/or verbal clearance to administer whole blood in a clinical setting by the Agency Medical Director or their designee.

*Although Basic Life Support (BLS), and non-authorized Advanced Life Support (ALS) clinicians will not be credentialed in the administration of whole blood, they will have the opportunity to complete a "Whole Blood Awareness" training module on FireRescue1 Academy. Clinicians not trained in the administration of whole blood are expected to be able recognize the signs and symptoms of hemorrhagic shock and request whole blood resources as early as possible.

2. Ongoing Maintenance of Credentials for Authorized Advanced Life Support (ALS) Clinicians
    a. In-person demonstration of blood product storage, administration, and documentation procedural skills.
    b. Evaluation of simulated resuscitation scenarios involving use of whole blood products.
    c. This shall be conducted annually or otherwise at the discretion of the Agency Medical Director or designee.
    d. A training record of initial and ongoing maintenance of credentials including LMS and hands on training shall be maintained for all credentialed personnel.

A. Daily Operations

1. AM Shift Check of blood products and associated equipment must be done daily by 07:00 upon change of personnel, or as soon as reasonably possible.
2. The ***CCDFEMS Whole Blood Daily Check*** form will be completed and submitted after the daily check. The daily check form can be found in SharePoint or can be accessed via the hyper-link or QR code below. The incoming provider is responsible for the completion and submission of this form. This can be found on SharePoint in the Whole Blood Group.
3. The Minimal Blood Administration equipment shall include the following:
    a. [1] Delta Cooler bag containing:
        I. (1) TCI
        II. (1) Unit of Low-Titer O+ Whole Blood.
    b. [1] QinFlow Warrior Lite Blood Warmer Base
    c. [1] QinFlow Warrior Lite Blood Warmer Extension Cable
    d. [1] QinFlow Warrior Lite Blood Warmer Compact Disposable Units (CDUs)
    e. [1] QinFlow Warrior Lite Blood Warmer Extra Battery
    f. [1] Specialized Filtered "Y" Blood Tubing
    g. [1] 500ml Pressure Bag
    h. [1] 500ml normal saline bag
    i. [1] LifeFlow Plus Rapid-Infuser
    j. [1] Labeled 2.5-gallon bag
    k. [1] Prefilled 10% Calcium Chloride
    l. [1] 1,000 mg vial of TXA
    m. [1] 100 mL NSS
    n. [1] 60 gtt/min IV drip set
    o. [2] Red patient identification bracelets
4. Also included within the "critical intervention bag" will be a transfusion reaction kit and will include the following:
    a. [1] 10mg/ ml vial of Dexamethasone (Decadron)
    b. [1] 50mg/ ml vial of Diphenhydramine Hydrochloride (Benadryl)
    c. [2] 3ml syringes
    d. [2] Blunt fill needles
    e. Alcohol prep pads

CCDFEMS Whole Blood Daily Check

5. Daily Changeover should include the following:
    a. TCIs in the Delta 2L replaced with a frozen/conditioned TCI from the storage freezer at the start of every shift.

I. The frozen TCI shall be removed from the TCI freezer, placed on the TempWatch, and left at ambient room temperature. Remain within hearing distance.
II. An audible alarm will sound on TempWatch when the TCI reaches 2°C.
III. Wipe TCI dry of moisture. Move the blood to the new TCI and place both in the Delta cooler, securing the lid.
IV. Inspect the Hemo-Trac on each unit of blood to confirm that it has not been compromised. A **BLUE color on the window** indicates a breach in the unit.
V. Complete the Whole Blood Daily Check and place the used TCI into the storage freezer.

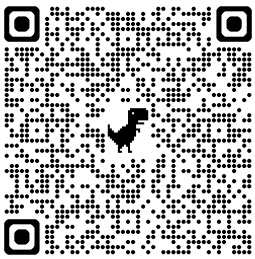
B. **Blood Accountability**

Each on-duty Chase Car Clinician is responsible for the daily accountability, exchange of TCIs, and temperature monitoring of their unit's blood products. The Clinician shall always keep the assigned cell phone/iPad on their person to receive automated push notifications from the Delta cooler. The designated Blood Program Manager shall maintain an electronic temperature data logger. The electronic log database records shall be maintained for three (3) years for inspection by Inova Blood Donor Services (Inova), MIEMSS, and/or other regulatory agencies.

C. **Exchange or Replacement of Blood Products**

All blood products in CCDFEMS' possession will be routinely exchanged every **14 days** by Inova via their courier. The exchange will take place at the Public Safety Training Center (PSTC), where a temperature-controlled refrigerator is available to store both old and new blood units. On the day of the scheduled exchange, each chase vehicle will report to the Public Safety Training Center prior to the scheduled arrival of the Inova courier. Each chase vehicle will offload their unit of whole blood into the designated temperature-controlled refrigerator and then return to their respective battalion. EMS101 will leave their Delta Cooler at the PSTC to allow for either EMS100 or OPS101 to respond and provide whole blood products throughout the county should an incident occur during the exchange window. Once the exchange has been complete with the Inova courier, each chase vehicle will report back to the Public Safety Training Center to retrieve the replacement units of whole blood. The exchange and replacement of whole blood shall be documented using the electronic ***CCDFEMS Whole Blood Exchange and Replacement Form*** which includes the lot numbers, a picture of each unit of blood, and the time of exchange. The Shift Commander/designee or another CCDFEMS representative must be present to receive and exchange blood products with the Inova courier. The Exchange and Replacement form can be accessed through SharePoint or the hyper-link and QR code below.

Whole Blood Exchange and/or Replacement Form



1. If rare, extenuating circumstances prevent a CCDFEMS designee or representative from being available for the exchange, the Shift Commander shall contact the appropriate Inova representative to reschedule. Additionally, the Blood Program Manager and Agency Medical Director shall be notified of the delay.

2. In the event of the Public Safety Training Center being unavailable or inaccessible for unit exchanges with the Inova courier, the secondary exchange location will be Station 14 (Winfield). Notification of the location change will be made from the Shift Commander to the Blood Program Manager, the Agency Medical Director, and the Inova representatives. The exchange procedures shall remain the same.

3. If a unit of whole blood is administered within the first seven (7) days of the 14-day replacement cycle, the on-duty Shift Commander will contact Inova to request a "stat shipment". However, if a unit is administered within the seven (7) days leading up to the end of the replacement cycle, there is no immediate need for a stat shipment.

4. The Shift Commander, Blood Program Manager, and Agency Medical Director may reallocate blood units as necessary to ensure adequate availability and coverage throughout the county or arrange for stat shipments outside of the standard replacement procedure.

D. **Blood Discrepancies**

1. If the Hemo-Trac indicates a breach of the blood unit and/or if the temperature falls outside of the accepted range, a Shift Commander and the Blood Program Manager shall be notified immediately who shall then contact Inova for further instructions. If the unit of blood is breached as shown by the Hemo-Trac window, the following actions must be taken immediately:

    a. Keep the affected blood in the Delta and alert the Shift Commander and Blood Program Manager by phone, who shall notify the Agency Medical Director. If unable to reach to Blood Program Manager by phone, text message **AND** e-mail notifications shall be sent as soon as possible.
    b. Take a picture of the Hemo-Trac with lot number.

c. The Blood Program Manager shall produce a temperature data log report and immediately notify Inova to inform them of the temperature excursion. The decision to exchange or discard blood products shall be at the discretion of Inova.
d. At the discretion of the Blood Program Manager, the Clinician shall perform immediate preliminary efforts to determine how, when, and why the discrepancy may have occurred. If the initial gathering of information cannot rule out tampering or inappropriate use of blood or equipment, the discrepancy shall be considered unresolved, and further investigation will be required.
e. The Blood Program Manager shall provide a summary of the preliminary investigation to the on-duty Shift Commander and Agency Medical Director.
f. If further investigations reveal inappropriate handling or access to blood products, or its associated equipment, internal escalation shall result at the discretion of leadership staff and the Agency Medical Director.
g. If the recorded temperature falls below 2ºC or between 6-10ºC for more than 30 minutes, the following actions must be taken immediately:
h. Immediately move the Delta 2L cooler to an acceptable ambient temperature environment.
i. Follow the above procedure for TCI exchange.

2. If the temperature excursion cannot be corrected within 30 minutes:
    a. The unit shall go out of service and report to the closest station with a conditioned TCI, if not in quarters.
    b. While enroute to change TCI, attempt to have in-station personnel remove a conditioned TCI and place it on the conditioning mat with TEMPWATCH.
    c. Complete the daily blood form as blood products are being moved to the new TCI.
    d. Notify the Blood Program Manager and provide the following information:
        I. The maximum/minimum temperature recorded
        I. The event(s) causing the temperature to fall out of range
        II. What actions have been done to return blood to acceptable range.

E. **<u>Administration</u>**

Whole Blood Products shall be administered in accordance with the indications outlined within the Maryland Medical Protocols. Whole Blood Products may be indicated in a variety of patients who are suffering internal or external hemorrhage as a result of either medical or traumatic origin. Whole Blood shall only be administered by ALS clinicians who meet the training, qualification, and certification requirements as set forth by the Medical Director and designees, and that are outlined within this policy.

1. Administration of Whole blood products should follow the chronological directions as outlined in the attached document ***Whole Blood Administration Procedures***.

2. The general procedures for Whole Blood administration are outlined in the Maryland Medical Protocols and are as follow:

    a. Ensure applicable hemorrhage and shock interventions: tourniquet, wound-packing, pelvic binder, and thoracic decompression.
    b. Assess for contraindications to administration of Whole Blood.
    c. Obtain IV access (18 gauge or larger, if possible), and keep IV catheter hub accessible to allow direct connection of blood tubing. A large-bore IV extension set, and large-bore stopcock may be utilized if available. Obtain pre-transfusion blood sample, if time and patient's condition permit.
        I. IV infusion is preferable to IO infusion for optimal flow rates.
    d. Transfuse Whole Blood:
        I. Patients less than 35 kg: Administer 10 mL/kg IV/IO
        II. Patients greater than or equal to 35 kg: Administer 1 unit IV/IO
    e. Apply Whole Blood identification bracelet to patient's wrist or ankle.
    f. Assess for signs of transfusion reaction: hives, wheezing, rigors, fevers, abdominal pain, vomiting, sudden worsening of hypotension or tachycardia that is not consistent with patient's underlying condition.
    g. Assess for clinical improvement for patients with non-compressible hemorrhage: Look for signs of improved perfusion with presence of central pulses but exercise
    a permissive hypotension approach. Target to SBP of:
    I. 90 mmHg for patients less than 35 kg
    II. 100 mmHg for patients greater than or equal to 35 kg
    III. 110 mmHg for patients greater than or equal to 35 kg with significant TBI
    h. Reassess for signs of transfusion reaction.

In the cases where a patient experiencing suspected hemorrhagic shock, consider administration of Tranexamic Acid (TXA) if indicated in accordance with Maryland Medical Protocol. Much like Whole Blood, early administration of TXA is ideal, but initial management of ABCs must first take place. TXA may be given before blood in the same IV/IO line, after blood in the same IV/IO line, or at the same time in a **different** IV/IO line but cannot be given simultaneously in the same IV/IO line as blood.

After administration of the first unit of Whole Blood administer calcium chloride through a separate IV/IO line or after flushing the primary IV/IO line. Follow Maryland Medical protocol dosing as indicated:

    a. Patients less than 35 kg: 20 mg/kg slow IV/IO
    b. Patients greater than or equal to 35 kg: 1 gram slow IV/IO

Blood Products should be administered utilizing the LifeFlow fluid administration device along with associated, commercial IV tubing. In circumstances which the LifeFlow device or associated IV

tubing is compromised or unavailable, the Whole Blood shall be administered with a pressure bag and the specialized filtered "Y" blood tubing.

F. Transfer of Patient Care

The clinician who administered Whole Blood shall accompany the patient and other providers during transport to the respective facility if applicable and feasible. In cases where patient care is laterally transferred to a service and provider that is certified in Whole Blood administration where accompanying the patient and providers may be challenging (e.g. Maryland State Police Aviation Command), the clinician who administered Whole Blood is not required to accompany the patient for the remainder of transport to definitive care.

If patient care is transferred to a service such as Maryland State Police Aviation, and whole blood has been administered prior to the arrival of the service and transfer of patient care, the empty whole blood bag and pre-transfusion blood sample, if obtained, should be transferred with the patient and to the new providers so that it may be provided to the receiving facility.

Upon hospital arrival, inform receiving team of patient's receipt of whole blood, and provide empty whole blood bags and pre-transfusion blood sample, if obtained, for hospital blood bank evaluation. Patients who receive Whole Blood shall have a red identification bracelet placed on either the patient's wrist or ankle. If able, the time of administration should be documented in black ink on the bracelet.

VI. DOCUMENTATION

Proper documentation of blood product acquisition, exchange, and usage is imperative for the evaluation of the blood program's efficacy. Additionally, this data is collected and observed by National Emergency Medical Services Information System (NEMSIS), MIEMSS, and Inova.

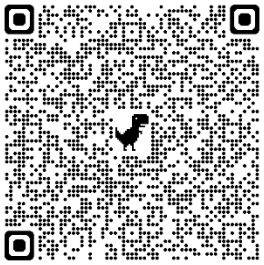
A. **Documentation of Blood Exchange and/or Replacement**

The ***CCDFEMS Whole Blood Exchange and Replacement Form*** shall be completed at the time of replacement and/or exchange of blood products by the provider conducting the exchange with the Inova courier. This form shall be submitted promptly prior to leaving the Public Safety Training Center and/or disseminating the blood products to other units. This document can be found on SharePoint in the "DFEMS Whole Blood" Group. Should there be any discrepancies or concerns during the exchange, the Blood Program Manager and Agency Medical Director should be notified via e-mail as soon as possible, in addition to the completion of the form.

B. **Documentation of Blood Product Usage**

The ***CCDFEMS Whole Blood Administration Log*** shall be completed immediately upon completion of the call, or as soon as reasonably possible. This document can be found in SharePoint within the "DFEMS Whole Blood" group or can be accessed via the hyper-link and QR code below.

CCDFEMS Whole Blood Administration Log



The on-duty Shift Commander shall be notified by phone immediately upon completion of the call, or as soon as reasonably possible. Additionally, an e-mail notification shall be sent to the Blood Program Manager and Agency Medical Director. This notification must include, at minimum, the incident number, amount of blood given, and any exceptional circumstances or concerns during the call. Either EMS100 or MD1, will notify the Center Medical Director when a unit of Whole Blood is transfused in the field. The notification shall include the transfusion date, the unit number, and the receiving facility. Notifications shall be sent to the Center at IBDSdistribution@Inova.org

C. **Documentation In eMEDS:**

1. Clinicians shall document the administration of Whole Blood via the eMEDS PowerTool labeled "Blood Trans" which is located on the righthand side while completing the report. After the prompted information is completed, the relevant details will automatically populate into the "Procedures" and "Medications" tab of the eMEDS report.

2. Additionally, clinicians should include the following in the eMEDS report:
    a. A photo of the blood unit administered (with Hemo-Trac and lot number visible) uploaded under the "Attachments" tab and labeled as "Other Picture/Graphic".
    b. The initiation and completion times of the Blood Transfusion documented within the "Narrative" section of the eMEDS report.

VII. RECISION

This Standard Operating Procedure rescinds all directives regarding LTO+ Whole Blood Program or similar content previously issued for personnel of the Carroll County Department of Fire & EMS.

VIII. RELATED STANDARD OPERATING PROCEDURES / DOCUMENTS

A. The Maryland Medical Protocols For Emergency Medical Services

IX. ATTACHMENTS

Whole Blood Administration Procedures
SOP 3.48 Attachment A

The following information is based on device manufacturers' recommendations and most effective practices.

1. Connect QinFlow battery and base unit and check battery level. Connect extension cord to base if needed.
2. Remove LifeFlow set from packaging. Close all clamps and spike NSS bag.
3. Connect LifeFlow to CDU at the short tubing set labeled "In."
4. Open NSS clamp and squeeze the lower air-check chamber so that fluid is above filter and ball is floating. There should be NO air gap in either lower or upper chamber, unlike regular IV tubing.
5. Load LifeFlow syringe into infuser by securing the white plunger into the blue slot with the numbers facing up.
6. Squeeze the LifeFlow infuser to prime LifeFlow and CDU to remove air from all units and tubing.
7. Connect the distal end of the CDU to the IV catheter hub or extension set. Flow NSS to ensure patency.
8. Attach CDU to base unit of QinFlow Warmer.
9. Allow base unit to go through checks. • The battery indicator and green check light will remain on; it may be solid or blinking. • If the red "X" illuminates, replace CDU and reprime. • If the red "X" illuminates again, place Qinflow out of service and administer blood without warmer.
10. Squeeze LifeFlow infuser to flow NSS and reaffirm patent flow to patient.
11. Remove unit of blood products from the Delta, inspect Hemo-Trac, and slightly agitate.
12. Spike blood bag. Close NSS clamp and open blood clamp. Squeeze the air-check chamber to remove small amount of air reintroduced from spiking blood bag.
13. Squeeze LifeFlow infuser to administer blood. Each squeeze provides 10 mL.
14. Monitor vitals and observe for signs of transfusion reaction*.
15. Place wristband on patient and take picture of unit of blood with lot number.

16. If not already done, administer TXA and consider 1 gram Calcium Chloride per Maryland Medical Protocols.
17. Provide empty blood bag to receiving nurse or physician.
18. Notify the on-duty Shift Commander via phone immediately upon completion of the incident and send an email notification to MD1. Additionally, an email notification shall be sent to Blood Program Manager and Agency Medical Director.
19. Document blood administration in the "Whole Blood Administration Log" and in EMEDS under both the procedures and medication tab, to include picture(s) of the unit(s) of blood.

***If a transfusion reaction occurs, immediately stop blood administration**, treat for an allergic reaction, and notify receiving hospital. Place unit of blood, CDU, and LifeFlow in the supplied 2.5-gallon bag to provide to hospital. A new transfusion from a different unit of LTO+ WB with new LifeFlow and CDU may be initiated if patient reassessment indicates continued need for blood.

Whole Blood Administration- Troubleshooting Guide

SOP 3.48 Attachment B

The following information is based on the Maryland Medical Protocols and device manufacturers' recommendations.

Problem	User Action
Transfusion Reaction: signs include hives, wheezing, tremors, fevers, abdominal pain, vomiting, sudden worsening of hypotension/tachycardia that is not consistent with patient's underlying condition	Immediately stop transfusion and treat for allergic reaction per the MMP. Notify the receiving hospital ASAP. Place unit of blood, CDU, and LifeFlow in the supplied 2.5-gallon bag and provide to hospital. Patient may receive a new unit with an entirely new set-up if need for blood persists.
Air in Chamber/Air-Check Ball Begins to Drop: indicates air in chambers or that you are out of blood and/or fluid.	Stop infusing and check fluid and blood bags. If there is still volume in the bags, re-prime the air-check chamber. If no volume remains, disconnect the tubing from the patient, spike a new bag if needed and re-prime the line.
Air in Tubing Below the Air-Check Chamber	Stop infusing and disconnect from the patient. Re-prime the entire line and CDU with NSS prior to connecting to the patient.
Vacuum in the Air-Check Chamber: indicates that you are out of fluid	Close blood clamp. Open NSS clamp and squeeze the air-check chamber to refill and release vacuum.

LifeFlow Trigger Not Engaging the Syringe: indicates that the syringe plunger is not properly seated into the shuttle.	Open the LifeFlow infuser and place the edge of the syringe plunger into the slot of the blue shuttle.
Resistance in LifeFlow Trigger: indicates interruption in flow downstream from the LifeFlow, or infusion is too rapid.	Slow down the rate of squeezing the trigger. If that does not work, stop infusing. Ensure IV clamps are open, IV is patent, and that there are no kinks in the tubing. DO NOT APPLY EXCESSIVE FORCE TO TRIGGER.
LifeFlow Trigger Breaks Off During Use: this is a safety feature designed to mitigate excessive pressure during transfusion.	Open the LifeFlow and remove syringe from the shuttle. Discard the LifeFlow infuser and continue infusion using manual push-pull technique on the syringe or apply a pressure bag.
QinFlow- No Lights on Panel: CDU is attached but system does not turn on or initialize. No indication lights on panel.	Press the on/off switch, if no response replace battery with a fully charged battery or plug in extension cord. If issue persists, replace CDU. If still not resolved, do not use warmer. Remove CDU and infuse the cold blood products.
QinFlow Blue Indicator Light On: indicates fluid temperature is below set point; flow rate is higher than the warmer's capabilities.	Reduce infusion rate until blue indicator light turns off.
QinFlow Red Indicator Light On: indicates internal communication error between CDU and base unit or warning cutoff to prevent overheating.	Fix flow complications and restart unit. Ensure that the CDU is correctly primed. If problem persists, replace the CDU with a new one, re-prime, and connect it to base unit. If it remains unresolved, do not use warmer.
QinFlow Low Battery Indicator: one steady battery bar remains indicating low battery.	Replace battery or plug in power cord.

QinFlow Battery Indicator Blinking: indicates critically low battery; blue light may also turn on as it reduces warming capability to preserve power.	Replace battery or plug in power cord. Unit will shut off without warning if unresolved.

Whole Blood Administration- Dosing Guide

SOP 3.48 Attachment C

On-line medical direction required for patients under 1 year of age.

AGE	IDEAL WEIGHT	ML OF BLOOD
PREEMIE	2 KG	20 mL
NEWBORN	4 KG	40 mL
4MO	6 KG	60 mL
6MO	8 KG	80 mL
1YR	10 KG	100 mL
2YR	12 KG	120 mL
3YR	15 KG	150 mL
4YR	17 KG	170 mL
5YR	20 KG	200 mL
6YR	22 KG	220 mL
7YR	25 KG	250 mL
8YR	27 KG	270 mL
9YR	30 KG	300 mL
10YR	35 KG	1 Unit (500 mL)

Whole Blood Administration- Calcium Chloride Dosing Guide

SOP 3.48 Attachment D

AGE	IDEAL WEIGHT	MG	ML of CaCl
PREEMIE	2 KG	40 MG	0.4 mL
NEWBORN	4 KG	80 MG	0.8 mL
4MO	6 KG	120 MG	1.20 mL
6MO	8 KG	160 MG	1.60 mL
1YR	10 KG	200 MG	2.00 mL
2YR	12 KG	240 MG	2.40 mL
3YR	15 KG	300 MG	3.00 mL
4YR	17 KG	340 MG	3.40 mL
5YR	20 KG	400 MG	4.00 mL
6YR	22 KG	440 MG	4.40 mL
7YR	25 KG	500 MG	5.00 mL
8YR	27 KG	540 MG	5.40 mL
9YR	30 KG	600 MG	6.00 mL
10YR	35 KG	1 Gram	10 mL

Whole Blood Administration- Tranexamic Acid (TXA) Dosing Guide

SOP 3.48 Attachment E

AGE	Amount of TXA	Amount of TXA	Mixed in amount of Dilutant	Infusion Rate MG/ minute
<5YR	Requires Consult	N/A	100mL (NS, LR, D5W)	N/A
5YR to 11YR	500 MG	5 mL	100mL (NS, LR, D5W)	50 MG/minute
12YR and Older	1000 MG/ 1 Gram	10 mL	100mL (NS, LR, D5W)	100 MG/ minute

Whole Blood Administration- Indications Guide

SOP 3.48 Attachment F

Shock Index= Heart Rate ÷ Systolic BP

No Shock	Mild Shock	Moderate Shock	Severe Shock
<0.6	0.6≥ to <1.0	1.0≥ to <1.4	≥1.4

Indications:

Clinical suspicion for major blood loss, such as:

- Penetrating trauma to the trunk
- Unstable pelvic fracture or multiple long bone fractures
- Blunt trauma mechanism consistent with major internal blood loss
- Observed major external blood loss
- Signs and symptoms of massive GI bleed, ruptured aortic aneurysm, or ruptured ectopic pregnancy

WITH Evidence of significant physiologic compromise:

- Age-defined hypotension* **PLUS** at least **one** of the following:
- Age-defined tachycardia**
- ETCO2 less than 25
- Positive eFAST exam (if available)
- Lactate greater than 4 (if available)
- Capillary reperfusion greater than 3 seconds
- Altered sensorium thought not secondary to intoxication or head trauma
- Witnessed PEA cardiac arrest less than 5 minutes in duration

*Age-Defined Hypotension	**Age Defined Tachycardia
Ages less than 10YRS: systolic BP less than (70 + 2 x age in years)	Age 1 year: greater than 190
Ages 10-65: systolic BP less than 90	Ages 2-4 yrs: greater than 140
Ages Greater than 65: Systolic BP less than 100	Ages 5-12 yrs: greater than 140
Any age: absent radial pulses	Ages greater than 12 yrs: 120