FLUID MANAGEMENT AND BLOOD COMPONENT THERAPY

PURPOSE
A. To establish guidelines for the safe administration of intravenous medication and/or blood products either by bolus or by infusion

SCOPE
A. All current Lifeline employees

DEFINITIONS

POLICY STATEMENTS
A. If patient is suffering from obvious massive blood loss, consider blood product replacement before crystalloids (i.e. plasma and PRBCs)
   A. Excessive crystalloids can lead to acidosis and potentially worse outcomes in adult patients suffering from hemorrhagic shock
B. PEDIATRIC PATIENTS: If additional crystalloid fluid beyond 20 ml/kg in pediatric trauma patients is required, consider blood replacement
C. In any confirmed or suspected transfusion reaction:
   i. Replacement therapy must be immediately discontinued and reported if a transfusion reaction is suspected.
D. Other blood components provided by referring hospitals may be administered as patient’s clinical condition warrants.

GUIDELINES
A. For patients not requiring fluid resuscitation, consider IV fluids at a TKO rate, or at an increased rate as clinically indicated.

B. Patients who require aggressive fluid therapy:
   1. Adults: 20mL/Kg crystalloid IV bolus, may repeat x2 if necessary
   2. Pediatrics: 20 mL/Kg crystalloid IV bolus; may repeat x 2 if necessary
   3. Further fluid therapy based on patient response.
C. Parkland Formula for burn patients

1. Consider use of the Parkland formula for burn patients:
   i. $4 \text{mL crystalloid} \times \%\text{BSA} (2^{nd} \& 3^{rd} \text{degree burns}) \times \text{Kg} = \text{mL of crystalloid to be given over the first 24 hours post-injury (in addition to maintenance fluids.)}$
   ii. Give half of the amount in the first 8 hours and the remainder over the subsequent 16 hours.
   iii. Lactated Ringer’s solution is preferable to 0.9 NS, particularly in pediatric patients, to reduce the hyperchloremic acidosis.
   iv. This formula is a guideline and ongoing resuscitation should be based on patient response (i.e. urine output, vitals, capillary refill, etc.)

D. Blood product replacement therapy general indications and practices:

1. ADULT (non-traumatic patients, see below for trauma): PRBCs may be given to patients with a condition and/or history suggesting:
   i. significant ongoing blood loss
   ii. significant cardio- and/or cerebrovascular co-morbidities and a hemoglobin $< 10$ g
   iii. all other symptomatic patients with a hemoglobin $< 7$ g

2. PEDIATRIC (see below for pediatric trauma patients requiring massive transfusion): PRBCs may be given to any patient above the age of 4 months with a known or suspected history of trauma and a condition and/or history suggesting:
   a. significant ongoing blood loss
   b. significant cardio- and/or cerebrovascular co-morbidities and a hemoglobin $< 10$ g
   c. all other symptomatic patients with a hemoglobin $< 7$ g

3. Note: In patients with hemoglobin levels low enough to initiate transfusion that are non-traumatic, not secondary to acutely life-threatening hemorrhage, and that do not require reversal of anticoagulation, initial resuscitation is to be conducted with PRBCs. In rapid hemorrhage, hemorrhagic shock, or acute life-threatening hemorrhage the provider may opt to start resuscitation with plasma as indicated. See Trauma section for resuscitation in trauma.

4. Replacement therapy for blood products (non-traumatic)
   i. ADULT: Administer PRBCs and liquid plasma until adequate clinical improvement is evident. Alternate between PRBCs and liquid plasma with each subsequent blood product administration
   ii. PEDIATRIC: 10 mL/Kg boluses of PRBCs and 10 mL/kg liquid plasma until adequate clinical improvement is evident. Alternate between PRBCs and liquid plasma with each subsequent blood product administration
   iii. ALL PATIENTS: Resuscitation with blood products should attempt, whenever possible, to be done in a 1:1:1 ratio balanced between equivalent units of PRBCs, plasma, and platelets for massive transfusions. In the absence of platelets, alternate between PRBCs and liquid plasma
5. For ADULT TRAUMA Patients ONLY:
   i. **Inclusion Criteria:**
      a. Blunt or penetrating injured patients being transported from scene or referral hospital
         AND
      b. Systolic blood pressure below 90 mmHg AND tachycardia > 108 beats per minute at scene, or at outside hospital or during transport.
         OR
      c. Systolic blood pressure below 70 mmHg at scene, or outside hospital or during transport.
   ii. **Exclusion Criteria:**
       a. Isolated drowning or hanging victims
       b. Patients less than 16 years of age
   iii. **STEP 1:** Transfuse 2 units of plasma if inclusion criteria are met and no exclusion criteria exist AND the provider suspects significant hemorrhage prior to proceeding the PRBCs
   iv. **STEP 2:** RBC transfusion should be administered if any one of the following are present:
       a. Hypotension with systolic blood pressure < 90 mmHg persistently after plasma
       b. Altered mental status secondary to hypovolemia from hemorrhage
       c. Changes in skin color (pallor, mottling or cyanosis) secondary to hypovolemia from hemorrhage
       d. Tachycardia with heart rate > 120 beats per minute
       e. Capillary refill > 2 seconds
       f. Shock index (HR/SBP) > 0.9
       g. RBC transfusion initiated at a referring facility (inter-facility transports)
   v. **NOTE:** Cessation of transfusion can once systolic blood pressure is greater than 90 mmHg

6. For PEDIATRIC TRAUMA Patients ONLY:
   i. **Inclusion Criteria:**
      a. Blunt or penetrating injured patients being transported from scene or referral hospital
         AND
      b. Systolic blood pressure below age specific blood pressure of 70+(2xage) or 90 mmHg AND tachycardic for age (see reference) at scene, or at outside hospital or during transport.
   ii. **Exclusion Criteria:**
       a. Isolated drowning or hanging victims
       b. Patients less than 4 months of age
   iii. **STEP 1:** Transfuse 10 mL/Kg of plasma if inclusion criteria are met and no exclusion criteria exist AND the provider suspects significant hemorrhage prior to proceeding the RBCs
   iv. **STEP 2:** 10 mL/Kg PRBC transfusion should be administered if any one of the following are present after the administration of liquid plasma as above:
       a. Hypotension with systolic blood pressure < 70+(2xage) or 90 mmHg persistently after plasma
b. Altered mental status secondary to hypovolemia from hemorrhage

c. Changes in skin color (pallor, mottling or cyanosis) secondary to hypovolemia from hemorrhage

d. Tachycardia for age

e. Capillary refill > 2 seconds

f. Shock index (HR/SBP) > 0.9

g. RBC transfusion initiated at a referring facility (inter-facility transports)

v. NOTE: Cessation of transfusion once systolic blood pressure is greater than 90 mmHg or 70+(2xage)mmHg for patients less than 10 years old

7. Calcium chloride should be given following administration of PRBC’s in patients with known hepatic dysfunction, those who are likely suffering from an ischemic liver, or in those with a demonstrated low ionized calcium level (<1.2 mmol/L).

i. ADULT: after 6 units of PRBCs are given, consider replenishing calcium as below (counteracts citrate toxicity from PRBCs):
   a. Calcium chloride 1 g IV given over 10 minutes, or
   b. Calcium gluconate 3 g IV over 10 minutes

ii. PEDIATRIC:
   a. Consider Calcium replacement following 20 mL/kg of PRBC’s
      i. Calcium chloride 10 mg/Kg IV over 10 minutes
         i. Max dose 1 g
         ii. Calcium chloride must be given through a central line access for the pediatric patient
      ii. Calcium gluconate
         a. Can be given peripherally at 60mg/kg IV
         b. Max dose is 1 gram
         c. IV administration should not exceed 200mg/min

8. Every attempt should be made to administer blood products via the fluid warmer

9. Hypothermic patients or those requiring active rewarming will require utilization of the fluid warmer
10. If the patient develops signs or symptoms suggestive of a possible transfusion reaction (back/flank pain, chilling (sudden), dyspnea/shortness of breath, flushing, hypotension, hypoxemia, itching, rash, tachycardia, temp increase over 1 degree Celsius, wheezing, or suspected hemoglobinuria, or in rare cases symptoms suggestive of TRALI:
   i. Immediately stop the infusion and keep the IV site open with 0.9% sodium chloride using new IV tubing.
   ii. Assess temperature, pulse, respirations and blood pressure, and record on transfusion document.
   iii. Notify physician(s) and Blood Bank
   iv. Report and record both the pre-transfusion and reaction temperatures for a febrile transfusion reaction.
   v. Process for specimen collection: Send to Blood Bank
   vi. Remainder of donor blood with connected administration set
       Completed Transfusion Document (including back of document)

Document assessment findings and information regarding contact with physician in the patient’s medical record

Required Documentation:
   A. Type and amount infused of any fluid bolus
   B. Patient response to IV fluid therapy or blood product administration
   C. Patient consent or the need for emergency transfusion
   D. Persons checking the blood product and verified patient information
   E. Vital signs documented at the start of the transfusion, at 15 minutes and at the end of the transfusion
   F. Blood product type, unit number, volume infused
   G. Transfusion reaction if present. Patient symptoms, treatment. Contact Medical Control and document any orders and intervention outcomes
### 24 hour fluid calculation formula:

\[
\begin{align*}
0 - 10 \text{ Kg} &= 100 \text{ mL/Kg} \\
10 - 20 \text{ Kg} &= 50 \text{ mL/Kg} \\
> 20 \text{ Kg} &= 25 \text{ mL/Kg}
\end{align*}
\]

**EQUALS:**

total volume per 24 hours

### Hourly fluid calculation formula (4-2-1 rule):

\[
\begin{align*}
1 - 10 \text{ Kg} &= 4 \text{ mL/Kg} \\
10 - 20 \text{ Kg} &= 2 \text{ mL/Kg} \\
> 20 \text{ Kg} &= 1 \text{ mL/Kg}
\end{align*}
\]

**EQUALS:**

hourly infusion rate

### Example using 24 hour calculations for a 22 Kg child:

\[
\begin{align*}
1000 \text{ mL (for first 10 Kg pt weight)} + \\
500 \text{ mL (for the second 10 Kg pt weight)} + \\
50 \text{ mL (for the last 2 Kg of pt weight)}
\end{align*}
\]

**EQUALS:**

1550 mL/24 hours or 64.5 mL/h

### Example using 4-2-1 rule for a 15 Kg child:

\[
\begin{align*}
40 \text{ mL (for first 10 Kg)} + \\
10 \text{ mL (for last 5 Kg)}
\end{align*}
\]

**EQUALS:**

50 mL/hour

### Citations/References:

Policy# HM 1.01A (IU Health Blood Administration Policy, Adult)
Policy# HM 1.01P (IU Health Blood Administration Policy, Pediatric)