Plasma Dilution

AATB Quality/Donor Suitability Workshop
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Presentation Overview

- Basic Body Fluid Physiology
- What is Plasma Dilution and Why Do We Care?
- How Do We Evaluate Plasma Dilution?
- Case Presentations and Discussion
- Gray Matter Exercises
Chapter 1
Basic Fluid Physiology
**Fluid Compartments**

**Total Body Water**

- **Intracellular (Inside cells) fluid** 67%
- **Extracellular (Outside cells) fluid** 33%

**Blood Volume**

- **RBC 8%**
- **Interstitial Fluid 75%**
- **Plasma 25%**

**Basic Physiology**
What is Plasma?

- Liquid Portion of Blood ~55% of Blood Volume
- Contents
  - Water
  - Proteins
    - Albumin
    - Globulins/Immunoglobulins (Antibodies)
    - Fibrinogen (removed with clotting-serum)
    - Coagulation Factors
  - Electrolytes
    - Na, K, Cl, HCO₃
  - Hormones, metabolic products, etc.
  - Viral particles/antigens

Basic Physiology
Blood/Tissue Fluid Equilibrium

Blood pressure (32 mm Hg) = Osmotic pressure (22 mm Hg) - Net pressure out (10 mm Hg) = Osmotic pressure (22 mm Hg) - Blood pressure (15 mm Hg) = Net pressure in (-7 mm Hg)

Arterial end of capillary
INTERSTITIAL FLUID
Venous end of capillary
Physiologic Response to Hemorrhage

- Loss of blood volume produces a drop in blood pressure
- Increased heart rate and vasoconstriction
- Loss of blood components (RBCs and plasma proteins)
- Initial influx of fluid into vasculature from interstitial compartment (physiologic dilution)
- Slow redistribution (24-48 hrs) of plasma proteins
Why Do Patients Get IV Fluids?

- **Maintenance Therapy**
  - Route for administration of medications
    - Crystalloids
  - Fluid/electrolyte balance and nutrition
    - Crystalloids

- **Replacement Therapy**
  - Correction of deficits
    - Electrolyte and acid/base abnormalities- Crystalloid
    - Anemia- Packed RBCs
    - Coagulation Factors- FFP, cryoprecipitate
  - Volume resuscitation for hemorrhage
    - Crystalloids
    - Colloids
    - Blood Products
IV Fluids
Definitions

- **Blood**
  - Whole Blood
  - Packed Red Blood Cells (PRBCs)

- **Colloids (Large Molecules)**
  - Fresh Frozen Plasma (FFP), Cryoprecipitate
  - Albumin
  - Platelets
  - Polysaccharide solutions (Hetastarch, Dextran)

- **Crystalloids (Small Molecules)**
  - Salt solutions (Normal saline, Lactated Ringer’s)
  - Glucose solutions (D5W)
  - Total Parenteral Nutrition (TPN)
IV Fluid Distribution

**5% Glucose (D5W)**
Glucose is rapidly taken up by cells; water distributes proportionally to ALL compartments

1,000 mL D5W  →  ICF 670 mL  →  ISF 250 mL  →  ECF 330 mL  →  Plasma 80 mL

**Normal Saline (NS)**
Sodium concentration is similar to extracellular fluid; water distributes to ECF compartment

1,000 mL NS  →  ISF 750 mL  →  Plasma 250 mL

**Plasma Proteins (FFP)**
Large molecules stay in vessels; water distributes only to intravascular compartment

1,000 mL FFP  →  Plasma 1,000 mL

**Packed Red Blood Cells (PRBC)**
Unit volume is 75-80% RBCs and 20-25% Plasma

300 mL PRBC  →  RBC 225-240 mL  →  Plasma 60-75 mL
No Blood Loss

<table>
<thead>
<tr>
<th>Antibody Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 U/3L = 10 U/L</td>
</tr>
<tr>
<td>30 U/3.5L = 8.57 U/L</td>
</tr>
</tbody>
</table>

Blood Loss

<table>
<thead>
<tr>
<th>Antibody Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 U/2L = 10 U/L</td>
</tr>
<tr>
<td>20 U/2.5L = 8 U/L</td>
</tr>
</tbody>
</table>

Remember, 1L of NS increases the plasma volume by 250mL!
Chapter 2
What is Plasma Dilution and Why Do We Care?
What Do We Do With Plasma/Serum?

Enzyme Immunoassay (EIA)
So, What is Plasma Dilution and Why Should We Care?

- Loss of plasma proteins (IgG, and other stuff, like virus particles) with hemorrhage
- Addition of IV fluids will further dilute what remains
- The concentration of antibodies and/or viral particles may drop below the detection limit of the test
- 24-48 hours for redistribution of antibodies
- FDA says so- § 1271.80(d)
- This did happen with an organ donor in 1986
Chapter 3

How Do We Evaluate Donors for Plasma Dilution?
§ 1271.80 What are the General Requirements for Donor Testing?

- (d) Ineligible Donors. You must determine the following donors to be ineligible:
  - (2)(i) A donor in whom plasma dilution sufficient to affect the results of communicable disease testing is suspected, unless:
    - (A) You test a specimen taken from the donor before transfusion or infusion and up to 7 days before recovery of cells or tissue; or
    - (B) You use an appropriate algorithm designed to evaluate volumes administered in the 48 hours before specimen collection, and the algorithm shows that plasma dilution sufficient to affect the results of communicable disease testing has not occurred.
§ 1271.80 What are the General Requirements for Donor Testing?

(ii) Clinical situations in which you must suspect plasma dilution sufficient to affect the results of communicable disease testing include but are not limited to the following:

(A) Blood loss is known or suspected in a donor over 12 years of age [or regardless of blood loss if 12 or under], and the donor has received a transfusion or infusion of any of the following, alone or in combination:

(1) More than 2,000 mL of blood (e.g., whole blood, red blood cells) or colloids within 48 hours before death or specimen collection, whichever occurred earlier, or

(2) More than 2,000 mL of crystalloids within 1 hour before death or specimen collection, whichever occurred earlier.
5. Algorithms

Calculating blood and plasma volumes for donors in the 45-100 kg range, where there is blood loss with replacement:

- We recommend that you calculate and assess both blood volume and plasma volume as follows:
  - You may determine the blood volume in mL by dividing the body weight in kilograms by 0.015, or alternatively by multiplying the body weight in kilograms by 70 mL/kg.
  - You may determine the plasma volume in mL by dividing the body weight in kilograms by 0.025, or alternatively by multiplying the body weight in kilograms by 40 mL/kg.
Calculations for a 45-100 kg Donor

A = Total volume of blood transfused in the 48 hours before death or sample collection
B = Total volume of colloid infused in the 48 hours before death or sample collection
C = Total volume of crystalloid infused in the 1 hour before death or sample collection

BV = Donor’s Blood Volume
   - Calculated Blood Volume = Donor’s weight (kg) / 0.015 OR donor’s weight (kg) x 70 mL/kg

PV = Donor’s Plasma Volume
   - Calculated Plasma Volume = Donor’s weight (kg) / 0.025 OR donor’s weight (kg) x 40 mL/kg

Calculate Both:
1. Is B + C > PV? No - Test sample Yes - Sample Unsuitable
2. Is A + B + C > BV? No - Test sample Yes - Sample Unsuitable
How Do You Assess Plasma Dilution?

- Use a pre-transfusion/infusion sample for testing if available.
- If such a sample is not available, then you must determine if the donor received fluids sufficient to affect test results.
- The algorithm compares the fluids received within the specified time frames to the donor’s blood/plasma volume.
- If the algorithm shows >50% (1:2) dilution, then the sample is UNSUITABLE for ID testing.
Sample Plasma Dilution Algorithm

Is a sample available that was drawn before transfusion/infusion?  

- **YES**: Test Sample
- **NO**: Is Donor >12 years old?
  
  - **NO**: Perform Calculations
  - **YES**: Did blood loss occur?

  - **NO**: Test Sample
  - **YES**: Are any of the following conditions exceeded:
    1. 2000 mL blood or colloid within 48 hours, or
    2. 2000 mL crystalloids within 1 hour, or
    3. 2000 mL total combination of blood and colloid in last 48 hours with crystalloid in last hour

  - **NO**: Test Sample
  - **YES**: Perform Calculations

1271 Final Donor Eligibility Guidance Document Appendix 1
Where Do I get the Fluid Information?

- ICU Flowsheets
- Input/Output (I/O) records
- Transfusion Summary from blood bank
- Transfusion slips/records
Problems With Information

- Precise volumes not recorded
  - Look for administration rates
  - TKO (~45-50 mL/hr)
  - Extrapolate from concurrent data
  - Reasonable Maximums
  - Worst case scenarios

- “Units” of blood products
  - Transfusion slips, product label
  - Predefined unit volumes in SOP
Chapter 4

Gray Matter

Exercises
Plasma Dilution
Case 1

- 45 year old male presented to ER with severe chest pain and shock
- Became asystolic in ER within 45 minutes of arrival
- Received 1L NS by EMS
- Received additional 1L NS in ER
- 3rd bag of NS started in ER 10 min before code called, exact amount not recorded
- ME declared COD Myocardial Infarction
- Algorithm performed with 3,000 mL NS as “worst case”
Plasma Dilution
Case 1

- Donor Weight: 160 lbs (73 kg)
- Donor Height: 5’ 7”
- Estimated Blood/Plasma Volume
  - $BV = \frac{73 \text{ kg}}{0.015} = 4,867 \text{ mL}$
  - $PV = \frac{73 \text{ kg}}{0.025} = 2,920 \text{ mL}$
- Blood + Colloid + Crystalloid = 3,000 mL $<BV$
- Colloid + Crystalloid = 3,000 mL $>PV$
- Is sample acceptable?

Where is the blood loss?
Plasma Dilution
Case 2

- 27 year old male; 5’ 8”, 81.8 kg
- Accidental GSW to head
- EMS: 22:38- 18g LAC NS 500mL
  22:42- 16g RAC NS 500mL
- ER: 23:00- TL Cath R Femoral
  Rapid Infuser
- Patient dies at 01:06. Postmortem draw
- Only fluid totals given on code sheet
  - 4 units PRBC (1000mL)
  - 6000 ml NS
- Per Recovery Agency, Nurse said “He got 1000mL NS in the last hour”
Plasma Dilution
Case 2

- Estimated Blood/Plasma Volume
  - BV = 82 kg/0.015 = **5,467 mL**
  - PV = 82 kg/0.025 = **3,280 mL**

- Blood + Colloid + Crystalloid = **2,000 mL < BV**
- Colloid + Crystalloid = **1,000 mL < PV**

- Is sample acceptable?

Is 1,000 mL crystalloid appropriate?
If not, what volume should be used?
Can you use 6000 mL/2.5 hrs = 2400 mL?
What other data may be helpful?
Case 2
Lab Tests, etc.

- **CBC:**
  - 23:33 Hgb 8.5 (13-18 g/dL)
    Hct 24.5% (40-54%)
  - 23:45 Hgb 5.3
    Hct 15.2%

- **Chemistry:**
  - 23:33 Total Protein 3.6 (6-8.3 g/dL)
    Globulin 1.3 (2.2-4.2 g/dL)

- ER MD estimates blood loss of 2000 mL
Case 2

- Sometimes it is just not clear cut.
- May require a judgment call by the Medical Director.
Case 3

- Obese 55 year old male presented to ER with severe abdominal pain and shock
- Severe Hypotensive Shock (60 systolic)
- Taken to OR for repair of aortic aneurysm
- >2.5-3L of free blood in abdomen
- Suffered cardiac arrest in OR
- Only a post-transfusion blood sample is available for infectious disease testing
Case 3

- **Fluids Received**
  - 48 hours prior to blood draw
    - 11 units PRBC (4070 mL)
    - 4340 mL Colloid
  - 1 hour prior to blood draw
    - 100 mL NS
  - 2.5 hours from EMS arrival to death:
    - 4000mL NS & LR
Case 3

- Donor Weight: 326 lbs (148 kg)
- Donor Height: 5’10” (178 cm)
- Estimated Blood/Plasma Volume
  - BV = 148 kg/0.015 = 9,867 mL
  - PV = 148 kg/0.025 = 5,920 mL
- Blood + Colloid + Crystalloid = 8,510 mL <BV
- Colloid + Crystalloid = 4,440 mL <PV
- Is sample acceptable?

Does a 10L blood volume sound reasonable?
Plasma Dilution Calculation Problems

- A donor who is obese
- A donor who weighs <45 kg or >100 kg
- Fat tissue is less vascular than muscle; therefore, less blood volume/gm of tissue mass
- Does the weight based formula recommended in the DE Guidance Document accurately estimate the donor’s blood/plasma volume?
Plasma Volume
Weight vs. Body Surface Area

Plasma Volume Calculation Comparison
Adult Male 5'10"
Donor Weight: 326 lbs (148 kg)  
Donor Height: 5’ 10” (178cm)  
Estimated Blood/Plasma Volume (BSA method)  
- $BV^1 = BSA^4 (m^2) \times 2740 = 7,047 mL$  
- $PV^{2,3} = BSA (m^2) \times 1630 = 4,192 mL$  
- Blood+Colloid+Crystalloid = 8,510 mL > BV  
- Colloid + Crystalloid = 4,440 mL > PV  
Fails- Sample NOT Acceptable  

FDA specifically states that calculations provided in the DE Guidance Document are for donors weighing 45-100 kg.

The weight-based calculations provide a good estimate of blood/plasma volume for an average sized adult, but are inaccurate for children and obese adults.

Other more physiologically appropriate calculations should be used in these populations.

What about males vs. females in the 45-100 kg weight range?
Linderkamp studied 160 children ages 1 hr to 14 years. Used idoinated albumin to establish nomograms for calculating blood volumes from height and weight.

<table>
<thead>
<tr>
<th>Age</th>
<th>No. of cases</th>
<th>Blood volume (ml/kg)</th>
<th>Plasma volume (ml/kg)</th>
<th>Red cell mass (ml/kg)</th>
<th>Hematocrit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0—1 day</td>
<td>15</td>
<td>81.9 ± 8.6</td>
<td>43.2 ± 4.6</td>
<td>38.7 ± 9.0</td>
<td>51.8 ± 7.4</td>
</tr>
<tr>
<td>2—30 days</td>
<td>15</td>
<td>84.4 ± 7.5</td>
<td>48.5 ± 6.2</td>
<td>35.9 ± 5.8</td>
<td>46.8 ± 5.9</td>
</tr>
<tr>
<td>1—2 months</td>
<td>10</td>
<td>79.4 ± 6.9</td>
<td>53.9 ± 4.9</td>
<td>25.5 ± 3.4</td>
<td>35.4 ± 4.7</td>
</tr>
<tr>
<td>3—6 months</td>
<td>13</td>
<td>76.6 ± 9.0</td>
<td>53.8 ± 7.6</td>
<td>22.8 ± 2.8</td>
<td>32.8 ± 3.3</td>
</tr>
<tr>
<td>7—12 months</td>
<td>12</td>
<td>82.4 ± 10.4</td>
<td>57.3 ± 6.9</td>
<td>25.1 ± 4.6</td>
<td>33.5 ± 2.9</td>
</tr>
<tr>
<td>13—24 months</td>
<td>10</td>
<td>86.1 ± 9.7</td>
<td>58.7 ± 5.4</td>
<td>27.5 ± 4.6</td>
<td>35.1 ± 2.2</td>
</tr>
<tr>
<td>2—3 years</td>
<td>9</td>
<td>80.5 ± 8.7</td>
<td>52.1 ± 4.3</td>
<td>28.4 ± 5.3</td>
<td>38.6 ± 3.6</td>
</tr>
<tr>
<td>2—3 years</td>
<td>8</td>
<td>79.0 ± 7.3</td>
<td>51.6 ± 4.0</td>
<td>27.4 ± 4.6</td>
<td>38.1 ± 3.6</td>
</tr>
<tr>
<td>4—6 years</td>
<td>6</td>
<td>76.7 ± 6.3</td>
<td>48.4 ± 4.7</td>
<td>28.3 ± 2.2</td>
<td>40.8 ± 1.9</td>
</tr>
<tr>
<td>4—6 years</td>
<td>10</td>
<td>77.4 ± 4.3</td>
<td>50.9 ± 4.2</td>
<td>26.5 ± 3.8</td>
<td>37.6 ± 4.8</td>
</tr>
<tr>
<td>7—10 years</td>
<td>10</td>
<td>79.6 ± 7.1</td>
<td>51.6 ± 1.9</td>
<td>28.0 ± 1.9</td>
<td>38.8 ± 2.9</td>
</tr>
<tr>
<td>7—10 years</td>
<td>14</td>
<td>72.7 ± 6.2*a</td>
<td>46.2 ± 5.1*b</td>
<td>26.5 ± 2.1</td>
<td>40.3 ± 3.3</td>
</tr>
<tr>
<td>11—14 years</td>
<td>14</td>
<td>74.4 ± 5.2</td>
<td>46.7 ± 3.6</td>
<td>27.6 ± 2.4</td>
<td>40.9 ± 2.4</td>
</tr>
<tr>
<td>11—14 years</td>
<td>14</td>
<td>68.3 ± 3.5</td>
<td>43.7 ± 2.2</td>
<td>24.6 ± 3.2</td>
<td>39.6 ± 3.8</td>
</tr>
</tbody>
</table>

*a P < 0.05; b P < 0.005 (t-test) when compared with the values of boys of the same age group
Thank You for Your Patience
Additional informational slides if needed.
### Maximum Flow Rates

#### TABLE 1. Flow Rates of Tested Catheters with Normal Saline Solution Under Gravity

<table>
<thead>
<tr>
<th>Catheter</th>
<th>Length (inches)</th>
<th>Mean Flow Rate (ml/min)*</th>
<th>Range (ml/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angiocath†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 gauge</td>
<td>2</td>
<td>93</td>
<td>92-84</td>
</tr>
<tr>
<td>16 gauge</td>
<td>2</td>
<td>75</td>
<td>74-75</td>
</tr>
<tr>
<td>16 gauge</td>
<td>5(\frac{1}{4})</td>
<td>64</td>
<td>63-65</td>
</tr>
<tr>
<td>18 gauge</td>
<td>1(\frac{1}{4})</td>
<td>55</td>
<td>—</td>
</tr>
<tr>
<td>20 gauge</td>
<td>1(\frac{1}{4})</td>
<td>38</td>
<td>37-39</td>
</tr>
<tr>
<td>22 gauge</td>
<td>1</td>
<td>24</td>
<td>—</td>
</tr>
<tr>
<td>24 gauge</td>
<td>(\frac{3}{4})</td>
<td>14</td>
<td>—</td>
</tr>
<tr>
<td>Quik Cath‡</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22 gauge</td>
<td>1</td>
<td>24</td>
<td>23-24</td>
</tr>
<tr>
<td>24 gauge</td>
<td>(\frac{3}{8})</td>
<td>15</td>
<td>—</td>
</tr>
<tr>
<td>Medicut§</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 gauge</td>
<td>2</td>
<td>92</td>
<td>90-94</td>
</tr>
<tr>
<td>16 gauge</td>
<td>2</td>
<td>81</td>
<td>80-82</td>
</tr>
<tr>
<td>18 gauge</td>
<td>2</td>
<td>62</td>
<td>61-63</td>
</tr>
<tr>
<td>20 gauge</td>
<td>2</td>
<td>42</td>
<td>41-42</td>
</tr>
<tr>
<td>22 gauge</td>
<td>1</td>
<td>26</td>
<td>—</td>
</tr>
<tr>
<td>Desilites-Hoffman Sheath®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 gauge</td>
<td>3(\frac{1}{2})</td>
<td>77</td>
<td>76-78</td>
</tr>
<tr>
<td>CVPeel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 gauge</td>
<td>4(\frac{3}{4})</td>
<td>28</td>
<td>28-29</td>
</tr>
<tr>
<td>20 gauge</td>
<td>2(\frac{3}{4})</td>
<td>26</td>
<td>28-27</td>
</tr>
<tr>
<td>Intramedicu§</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 gauge</td>
<td>8</td>
<td>31</td>
<td>—</td>
</tr>
<tr>
<td>18 gauge</td>
<td>8</td>
<td>13</td>
<td>—</td>
</tr>
<tr>
<td>20 gauge</td>
<td>8</td>
<td>5</td>
<td>4-5</td>
</tr>
</tbody>
</table>

* Rounded to the nearest ml.
† Deseret Medical, Inc., Sandy, Utah.
‡ Travenol Laboratories, Inc., Deerfield, Illinois.
§ Argyle-Sherwood Medical Industries, St. Louis, Missouri.
\(\text{**}\) Cook, Inc., Bloomington, Indiana.

#### TABLE 2. Flow Rates of Tested Catheters with Normal Saline Solution at 300 mm Hg Pressure

<table>
<thead>
<tr>
<th>Catheter</th>
<th>Length* (in)</th>
<th>Mean Flow Rate (ml/min)†</th>
<th>Range (ml/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angiocath‡</td>
<td>2 in</td>
<td>301</td>
<td>296-310</td>
</tr>
<tr>
<td>14 gauge</td>
<td>2 in</td>
<td>248</td>
<td>244-250</td>
</tr>
<tr>
<td>16 gauge</td>
<td>2 in</td>
<td>199</td>
<td>194-206</td>
</tr>
<tr>
<td>16 gauge</td>
<td>3(\frac{1}{4}) in</td>
<td>164</td>
<td>157-168</td>
</tr>
<tr>
<td>20 gauge</td>
<td>1(\frac{1}{4}) in</td>
<td>103</td>
<td>100-106</td>
</tr>
<tr>
<td>22 gauge</td>
<td>1 in</td>
<td>65</td>
<td>62-68</td>
</tr>
<tr>
<td>24 gauge</td>
<td>(\frac{3}{4}) in</td>
<td>42</td>
<td>42-43</td>
</tr>
<tr>
<td>Quik Cath§</td>
<td>1 in</td>
<td>68</td>
<td>67-70</td>
</tr>
<tr>
<td>22 gauge</td>
<td>(\frac{3}{8}) in</td>
<td>47</td>
<td>46-48</td>
</tr>
<tr>
<td>Medicut§</td>
<td>2 in</td>
<td>319</td>
<td>304-328</td>
</tr>
<tr>
<td>16 gauge</td>
<td>2 in</td>
<td>280</td>
<td>268-284</td>
</tr>
<tr>
<td>18 gauge</td>
<td>2 in</td>
<td>214</td>
<td>210-216</td>
</tr>
<tr>
<td>20 gauge</td>
<td>2 in</td>
<td>126</td>
<td>116-130</td>
</tr>
<tr>
<td>22 gauge</td>
<td>1 in</td>
<td>77</td>
<td>74-78</td>
</tr>
<tr>
<td>Desilites-Hoffman Sheath®</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16 gauge</td>
<td>3(\frac{1}{2}) in</td>
<td>228</td>
<td>212-240</td>
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<tr>
<td>CVPeel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 gauge</td>
<td>4(\frac{3}{4}) in</td>
<td>81</td>
<td>—</td>
</tr>
<tr>
<td>20 gauge</td>
<td>2(\frac{3}{4}) in</td>
<td>87</td>
<td>83-90</td>
</tr>
<tr>
<td>Intramedicu§</td>
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</tr>
<tr>
<td>16 gauge</td>
<td>20 cm</td>
<td>97</td>
<td>94-100</td>
</tr>
<tr>
<td>18 gauge</td>
<td>20 cm</td>
<td>51</td>
<td>50-52</td>
</tr>
<tr>
<td>20 gauge</td>
<td>20 cm</td>
<td>16</td>
<td>—</td>
</tr>
</tbody>
</table>

* For length, in = inches, cm = centimeters.
† Rounded to the nearest ml.
‡ Deseret Medical, Inc., Sandy, Utah.
§ Travenol Laboratories, Inc., Deerfield, Illinois.
\(\text{**}\) Argyle-Sherwood Medical Industries, St. Louis, Missouri.
\(\text{**}\) Cook, Inc., Bloomington, Indiana.

### ICU Flowsheet

#### Date: Mar 01 02 2009

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**WakeMed Critical Care Flowsheet**

### Transfusion Record

**WakeMed Transfusion Record**

**DO NOT DETACH UNTIL TRANSFUSION IS COMPLETE**

**UNCROSSMATCHED BLOOD**

- Component: RBC
- Unit Number: 12-04-52898
- Transfusion Start Time: 3:51:08
- Volume: 300

**Recipient Info**

- Name: D. P. L. B. C.
- ID: 12-04-52898

**Certificate of Physician**

- Signature: [Signature]
- Date: [Date]

**Patient Observations/Assessments**

- Vital Signs:
  - Temperature
  - Pulse
  - Respirations
  - Blood Pressure
  - Oxygen Saturation

**Result of Transfusion**

- Satisfactory
- Reaction noted - See Steps below

- Volume Given: 300 cc
- Time Completed: 3:51:08

**Place this copy in the nurses notes section of the patient's chart.**

If Signs/Symptoms of a Reaction Noted, do the following:

1. STOP the transfusion. Remove blood bag and any IV tubing attached to patient. Keep the IV open with normal saline with new IV tubing. Check VS including pulse oximetry. Record under observations.
2. Notify Transfusion Service.
3. Notify the physician.
4. Order TRANSFUSION REACTION STUDIES in the computer. Initiate Transfusion Reaction Standing Order.
5. Complete the Transfusion Reaction Investigation Report.
6. Return the blood bag, any IV's attached, a copy of this paperwork and the Transfusion Reaction Form to Transfusion Services.
7. Record intervention in nursing narrative.
Blood Volume Calculation Comparison
Adult Male 5'10"
3. Other Clinical Situations

- A donor who has previously had blood loss, stabilizes, then expires, but has received fluids in the 48 hours before sampling;
- A donor who is obese;
- A donor who in the absence of bleeding may have received large amounts of infusions which the medical director or designee believes may affect test results;
- A donor who weighs less than 45 kilograms or more than 100 kilograms.