

The Good Stuff at Last!

Introduction to out of hospital administration of blood products

Jeff Myers, D.O., Ed.M, NREMT-P
 Department of Emergency Medicine
 State University of New York at Buffalo
 myersj@alum.rpi.edu
 http://ems-ed.photoemdoc.com/

WHAT'S IN WHOLE BLOOD?

| Component | Purpose |
|------------------------------------|--|
| Red Blood Cells | Carry oxygen by way of hemoglobin |
| White blood cells | Part of immune system, fights infection by attacking and destroying foreign cells |
| Platelets | Help plug leaks in the blood vessels to form the base for a clot |
| Coagulation Cascade Factors | Helps form fibrin and fibrinogen, attracts platelets to build clot to plug leak in blood vessel |
| Fibrin and fibrinogen | End result of coagulation cascade, builds and solidifies clot |
| Other circulating proteins | Various things |

Whole blood is not used for transfusion any more

FRACTIONATED BLOOD COMPONENTS:

FRESH FROZEN PLASMA

- **RBCs** and **platelets** are removed
- Plasma quick-frozen retain factors **5 and 7 (coagulation factors important in coag cascade)**
- 1 unit is approx **200 ml**.
- Used to treat fatal clotting disorder from:
 - **Advanced liver disease**
 - **Anticoagulant overdose (warfarin/Coumadin)**
 - **Disseminated intravascular coagulation (clotting factors used up in smaller blood vessels)**

CRYOPRECIPITATE

- Prepared from **plasma**
- Each unit **25 – 50 ml**
- Contains:
 - **factor 5 (V)**
 - **factor 8 (VIII)**
 - **vonWillebrand factor (vWf)**
 - **fibrinogen**
 - **fibronectin**
- Uses:

- Hemophilia **A** or **vonWilebrand Disease** disease
- Low **fibrinogen** levels (massive transfusion)
- **excessive anticoagulation**
- **massive hemorrhage**
- **Disseminated Intravascular Coagulation**

PLATELETS:

- **6** units of platelets increases platelet count by **50,000** (normal is **150K – 450K**)
- Uses:
 - Administration depends on **platelet count** and **bleeding/procedure**
 - **massive transfusion**
 - May not be helpful in conditions that cause **platelet dysfunction because new platelets can become dysfunctional**

PACKED RBCs:

- **1** unit PRBC raises Hemoglobin by **1** gm/dl (normal 13 – 15 gm/dl)
- **1** unit = **250** ml
- Used for:
 - **acute blood loss**
 - **profound anemia with impaired oxygen delivery**
 - **massive transfusion** which is defined as **transfusing 1 – 2 body volume (approximately 10 – 20 units)**

BLOOD GROUPS AND COMPATIBILITY:

- RBC's have many **proteins** that can cause an **immunologic** reaction when exposed to a different blood type
 - The main type proteins are called **A** and **B** proteins
 - **Rh** proteins are either + or –
- The immunological reaction of receiver against donor blood of wrong type causes:
 - **attack by the patient's (receiver's) antibodies**
 - **the RBCs clump together**
 - **the RBCs burst and are destroyed**
- The major RBC types are:
 - **A**
 - **B**
 - **AB**
 - **O**
- Rh Factor is **a protein from the Rhesus monkey** and is either **positive(+)** or **negative(-)**
- Blood types are made up of RBC protein and Rh combination, yielding 8 major blood types

- There are other proteins on RBCs that can cause immunological reactions with about **29** different blood grouping systems

COMMON DEFINITIONS RELATED TO BLOOD PRODUCTS:

- Uncross-matched Blood: **blood that is not specifically matched to that patient given in an acute emergency when there is no time to give same blood. This is usually O+ or O- (O- in women of childbearing age and children)**
- Type Specific Blood: **blood that is matched in ABO and Rh only**
- Cross-matching: **mixing patient's blood with donor's blood to look for clumping indicating a reaction**
- Type and Crossed: **process of matching patient's blood against donor's blood with all 29 types of antibodies**

So who can receive what blood?

- Type A can receive: **A and O**
- Type B can receive: **B and O**
- Type AB can receive: **A, B, AB, and O <this is the universal recipient>**
- Type O can receive: **O only <this is the universal donor>**
- Rh + can receive: **Rh+ or Rh-**
- Rh – can receive: **Rh- only**

INDICATIONS FOR TRANSFUSION:

- **bleeding**
- **anemia either from decreased RBC production or increased hemolysis (destruction RBCs)**
- **pancytopenia (low counts all types of blood cells), for example in chemotherapy**
- **thrombocytopenia (low platelet count)**
- **clotting abnormalities (for example hemophilia)**

SAFETY OF TRANSFUSIONS:

- All donated blood is tested for many infectious diseases. The risk of disease transmission is low.

Transfusion Reactions:

TRANSFUSION ASSOCIATED CIRCULATORY OVERLOAD (TACO):

- The volume of 1 unit RBC + saline = **350** ml
- **Patients with impaired cardiac function are at risk**
 - **elderly**
 - **CHF or poor cardiac reserves**
 - **pediatric patients**
- Prevent TACO by **infusing blood at a slower rate than normal**

ALLERGIC TRANSFUSION REACTIONS:

- Reactions can range from **mild to severe**
- Signs / symptoms:
 - **pruritis, erythema**

- **tachycardia, hypotension, cardiac arrest**
- Fever is **ABSENT**
- **slow down transfusion**
- May require **medications to treat the allergic reaction**

FEBRILE NON-HEMOLYTIC REACTION:

- Temp increase by **1° C** within **2** hrs of starting the transfusion
- Signs and Symptoms include: **fever, chills, rigors, headache, nausea, or vomiting**
- Resolves spontaneously or with antipyretics
- May need to stop transfusion

ACUTE HEMOLYTIC REACTION:

- **10 % of ABO incompatibility fatal!**
- Signs / Symptoms:
 - **fever (>2°C above baseline), hypotension, dyspnea**
 - **pain at the site of the infusion, the back, or chest**
 - **hemorrhage, hemoglobinuria**
 - **nausea, vomiting**
 - **jaundice (yellow hue to skin), icterus (yellow sclera)**
 - **renal failure, disseminated intravascular coagulation**

BACTERIAL CONTAMINATION:

- 1/15,000 platelet & 1/500,000 RBC
- Signs and symptoms of sepsis:
 - **fever (>2°C above baseline), chills**
 - **hypotension, dyspnea**
 - **nausea, vomiting, diarrhea**

TRANSFUSION RELATED ACUTE LUNG INJURY (TRALI):

- **Adult Respiratory Distress Syndrome associated with transfusion**
- **Bilateral pulmonary edema**
- **hypoxia, dyspnea, fever, hypotension, cyanosis**

MANAGEMENT OF TRANSFUSION REACTIONS:

1. **Stop transfusion!**
2. **recheck patient bracelet and labels for error**
3. **change tubing**
4. **run normal saline**
5. **contact medical control**
6. **diphenhydramine** and **methylprednisolone** IV for allergic reactions
7. **epinephrine** IM for anaphylactic reactions
8. **supplemental oxygen**
9. **intubate / ventilate as needed** for TRALI
10. **furosemide** IV for volume overload

PROCEDURE & DOCUMENTATION:

IMPORTANT STEPS OF TRANSFUSION:

- Verify patient **identity**
- Verify patient **consent is present (or reason for no consent is documented)**
- Verify **transfusion order**
- Baseline **vital signs including temperature**
- Verify For All Units
 - **blood type**
 - **blood Rh factor**
 - **patient identity**
 - **blood expiration date/time**
 - **donor unit number**

Make Sure Donor Unit Number & Patient Information Match!

- Administration Sets: The **Y-type blood tubing** set is preferred over a **piggyback** set
- Vital Signs
 - Include **temperature**
 - **take baseline on receiving patient**
 - Every **15** minutes (**more frequent depending on patient condition**)
 - **after completion of each unit**

AFTER THE TRANSFER:

- **document reactions**
- **final set of vitals**
- **copy of record to hospital**
- **unused blood to blood bank**

TIME OF TRANSFUSION:

- Packed RBC's – **minutes to 2 hours (may go as long as 4 hours)**
- FFP – **30 – 50 minutes**
- Platelets – **30 – 60 minutes**
- Cryoprecipitate – **30 minutes**

HOW MUCH?

Based on severity of illness

Adult:

- **keep up with blood loss!**
- Maintain SBP **90-100** mmHg

Pediatrics

- **keep up with blood loss**
- Maintain **age appropriate systolic blood pressure**
- Infuse **10** ml/kg doses

Refer to orders!

BLOOD STORAGE:

- Store at **1 – 6°C**
- **30 minute** shelf life at room temperature
- **keep in appropriate transport cooler**