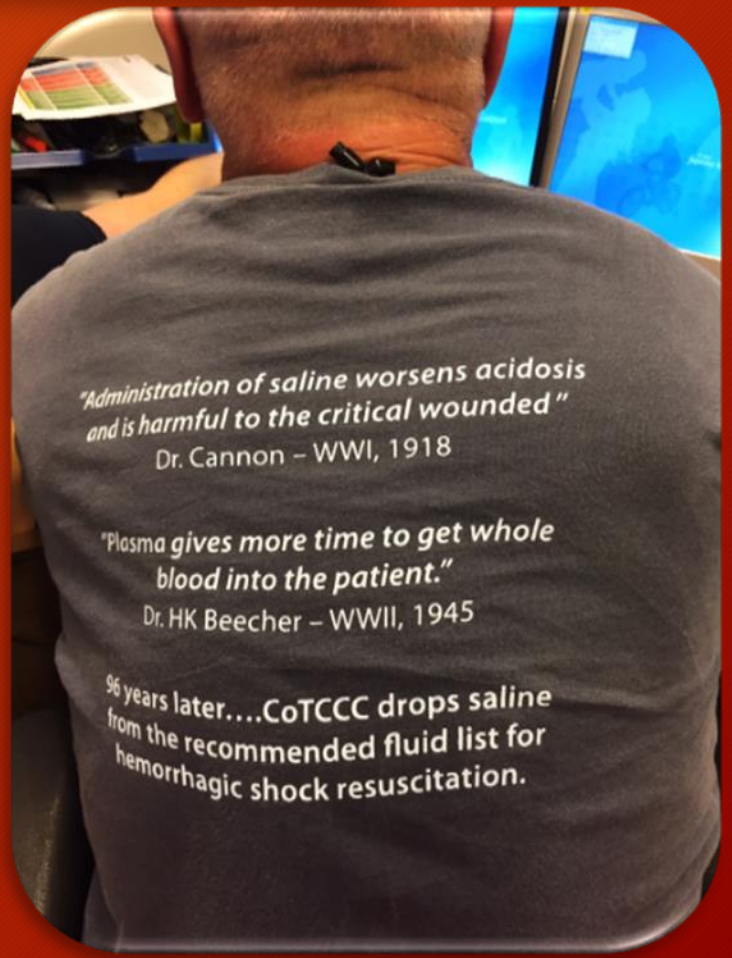
BLOOD ADMINISTRATION

Objectives

- Describe Blood and its components and functions of blood
- Identify rationale for blood administration
- Review policies and Standing Orders for blood administration
- Discuss and be able to identify signs/symptoms of blood transfusion reactions
- Explain logistics and storage requirements
- Outline documentation requirements

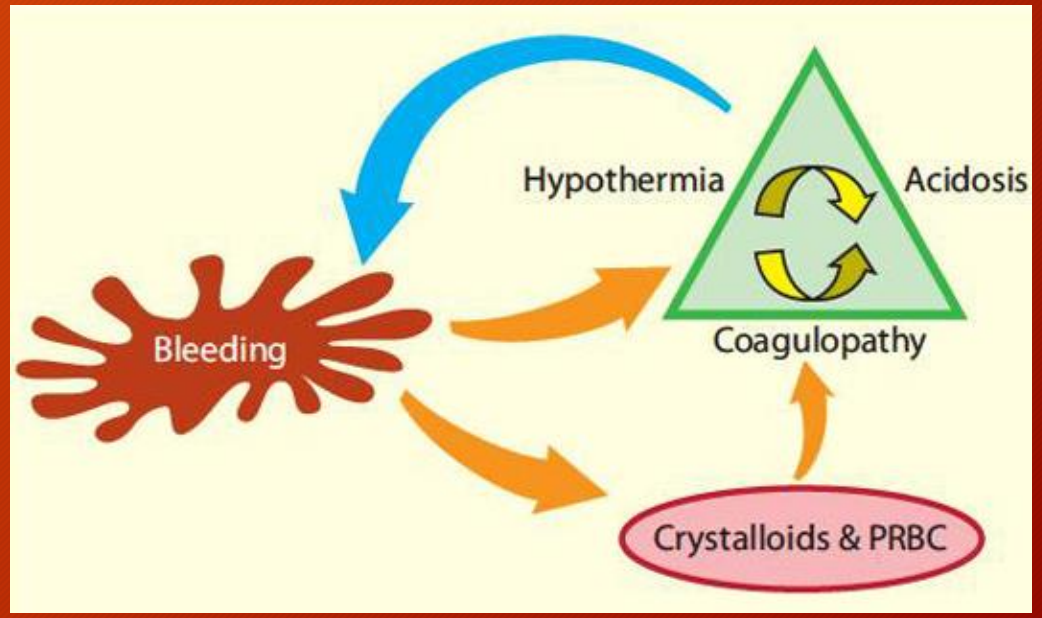
Saline is ineffective and dangerous

- Dilutes clotting factor
- Leads to hypothermia and acidosis
- Doesn’t carry oxygen
- Increases the speed of blood loss
- Multiple studies correlate saline administration with increases in mortality.



Why do we administer Blood Products?

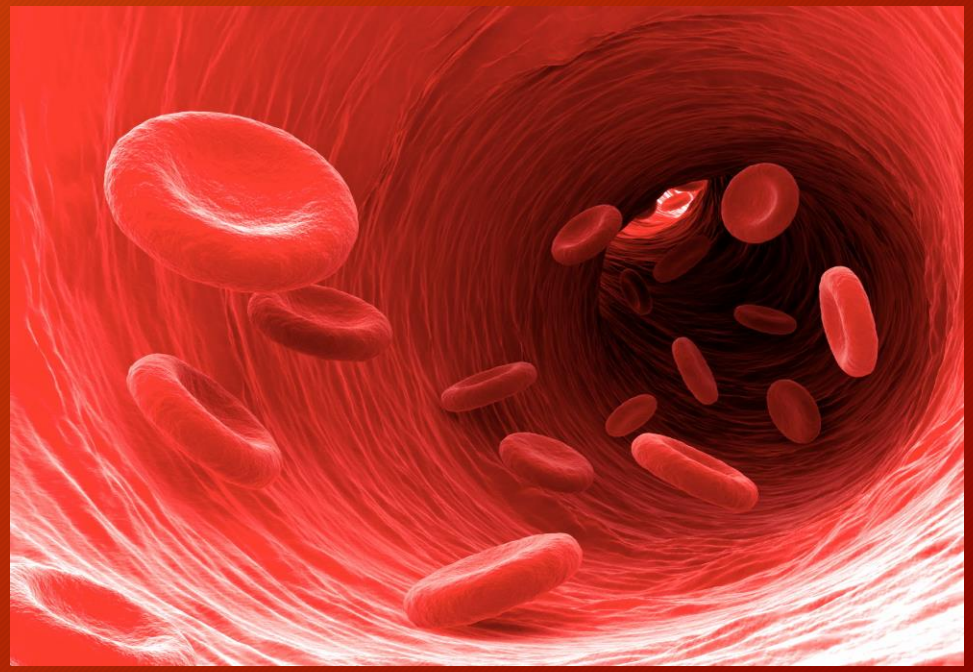
- Trauma's Lethal Triad
  - Hypothermia
  - Acidosis
  - Coagulopathy
- Warmed blood improves oxygenation of tissue, decreases hypothermia, provides clotting factor, and supports perfusion.



Pathophysiology

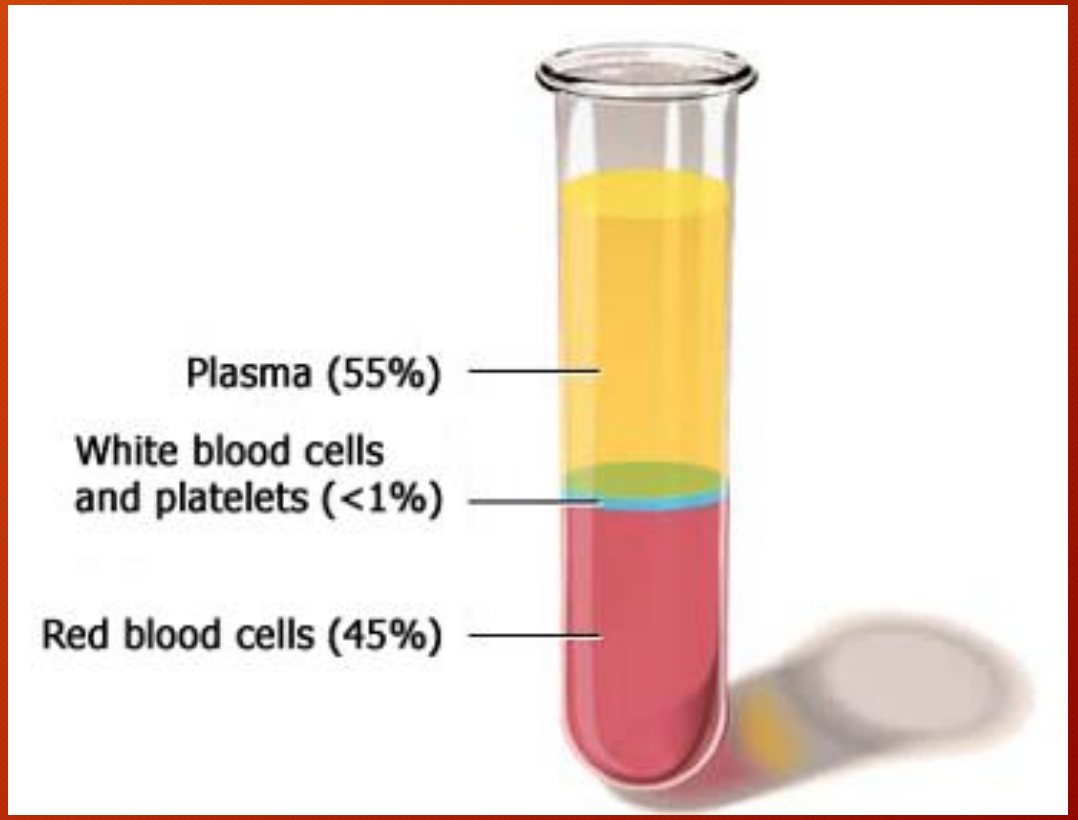
What is Blood?

- Body fluid in humans – delivers necessary substances such as nutrients and O2 to the cells
- Transports metabolic waste products away from those same cells
- Classified as a connective tissue
- Approximately 8% of body weight
- Males: 5-6 Liters
- Females: 4-5 Liters
- pH of 7.35 – 7.45
- Mean temperature of 38 degrees C



Components of Blood

- Plasma
- Erythrocytes (Red Blood Cells)
- Leukocytes (White Blood Cells)
- Thrombocytes (Platelets)

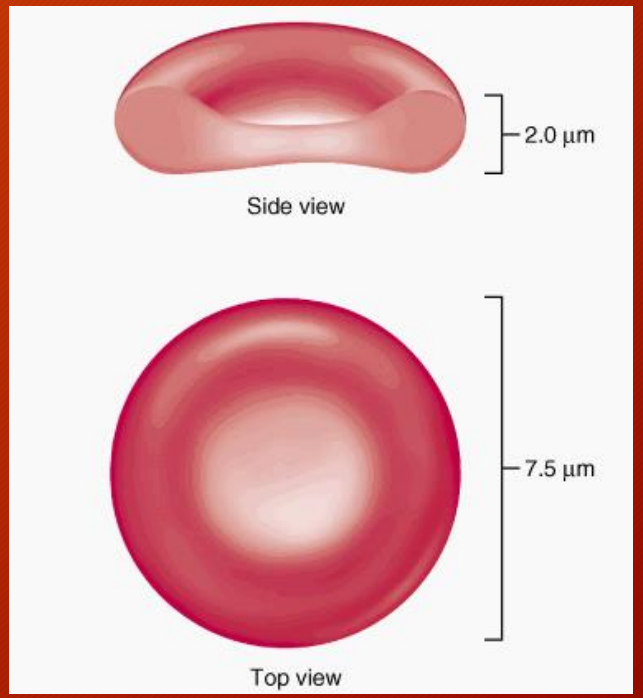


Components of Blood – Plasma

- Makes up approx. 55% of blood volume
- Water: 90 – 92%
- Plasma Proteins: 6 – 8%
  - Albumin – helps maintain proper blood osmotic pressure, important in exchange of fluids across capillary walls
  - Globulins – defensive proteins, antibodies or immunoglobulins
  - Fibrinogen – key protein in formation of blood clots
- Organic nutrients – glucose, carbohydrates, amino acids
- Electrolytes
- Non-protein nitrogenous substances – lactic acid, urea, creatinine

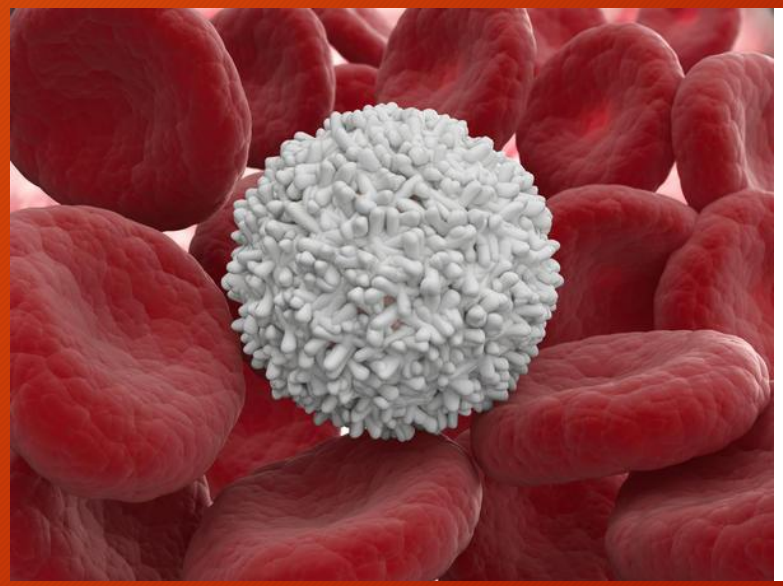
Components of Blood – Red Blood Cells

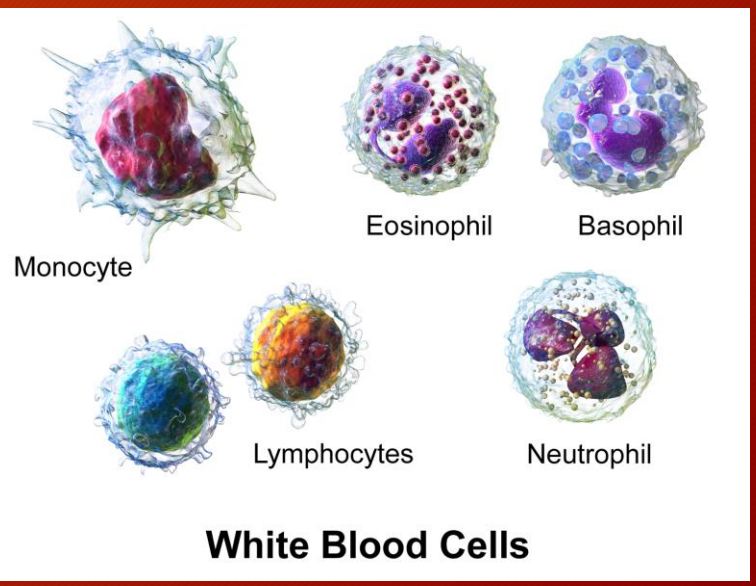
- 2 main functions of RBCs
  - Pickup and transport O2 from the lungs
  - Pickup and transport CO2 to the lungs
- Make up approx. 45% of blood volume
- Disc shaped cells with thick rim and a sunken center
  - Allows for quick diffusion of O2 and CO2
- Live for approx. 120 days before dying in the spleen
- Plasma membrane – glycoproteins and glycolipids determine blood type
- Inner membrane surface – actin and spectrin
- Incapable of aerobic respiration



Components of Blood – White Blood Cells

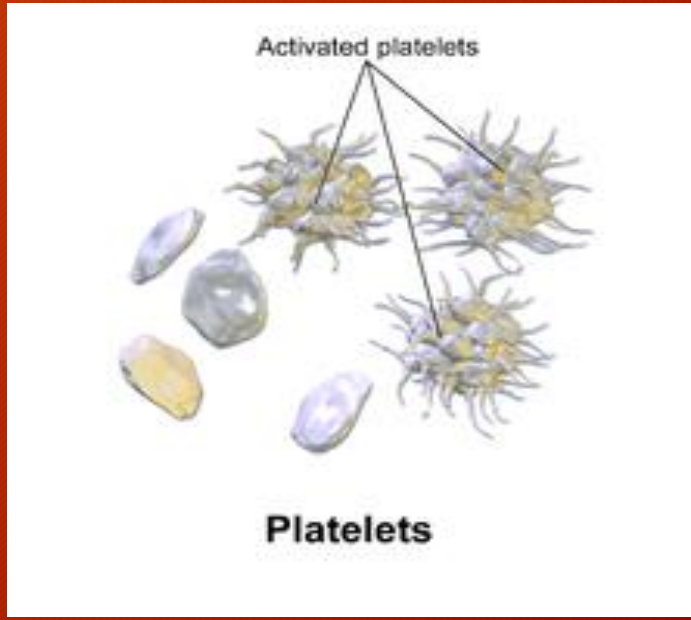
- Make up <1% of total blood volume
- All WBCs are nucleated
- Involved in protecting the body against infectious disease and foreign invaders
- 5 different types of WBCs





Components of Blood – Platelets

- Not really cells – small fragments of bone marrow cells
- Functions of platelets
  - Secrete vasoconstrictors
  - Form platelet plugs
  - Secrete procoagulants
  - Digest and destroy bacteria
  - Secrete chemicals to attract neutrophils and monocytes
  - Secrete growth factors to maintain linings of blood vessels



Three Main Functions of Blood

Transportation

- O2 and CO2 between the lungs and the rest of the body
- Nutrients from the digestive tract and storage sites to the rest of the body
- Waste products to be detoxified or removed by the liver and kidneys

Protection

- Leukocytes (WBCs) destroy invading microorganisms
- Antibodies and other proteins destroy pathogenic substances
- Platelet factors initiate blood clotting

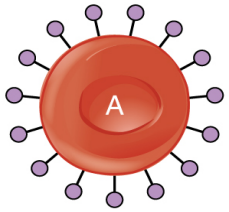
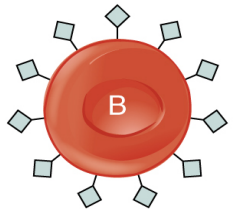
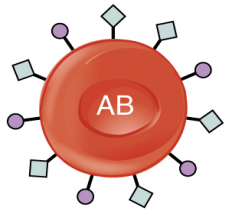
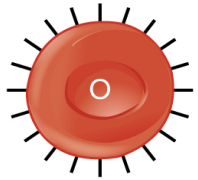
Regulation

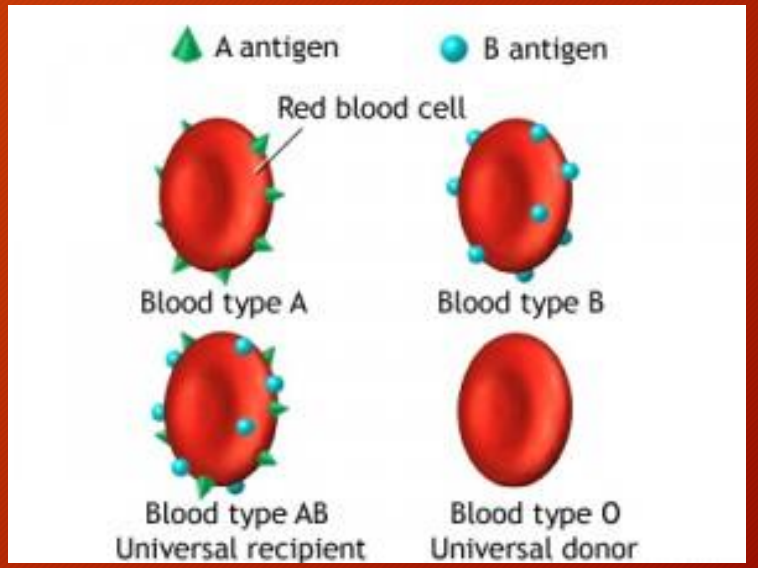
- pH
- Core body temperature

Blood Type – ABO System

- To determine the "type" of blood we should understand two things:
  - Antigens on the surface of red blood cells
  - Antibodies in the plasma
- 4 main "types"
  - Type A blood – A antigens on the red blood cell and anti B antibodies in plasma
  - Type B blood – B antigens on the red blood cells and anti A antibodies in plasma
  - Type AB blood – has both A and B antigens on the red blood cells and NO type antibodies in the plasma (Universal recipient)
  - Type O blood – has NO type antigens on the red blood cells and BOTH anti A and anti B antibodies in the plasma (Universal donor)

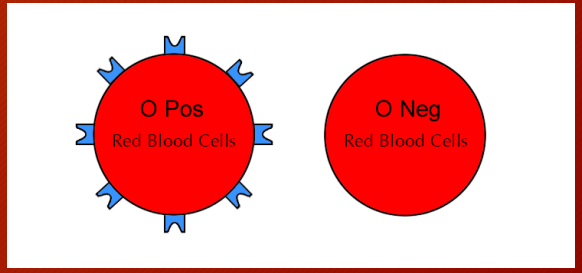
Blood Type – ABO System, Continued

	Blood Type			
	A	B	AB	O
Red Blood Cell Type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in Red blood Cell	A antigen	B antigen	 A and B antigens	None
Blood Types Compatible in an Emergency	A, O	B, O	A, B, AB, O (AB^+ is the universal recipient)	O (O is the universal donor)



Blood Type – Rh System

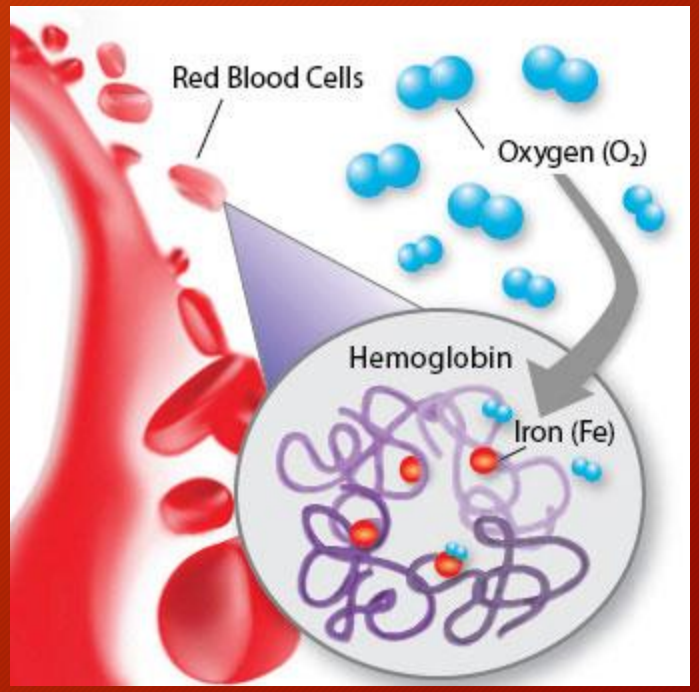
- Rh (Rhesus) blood grouping system consists of 50 defined blood-group antigens. D, C, c, E and e are the most important
- Rh positive & Rh negative ONLY refer to the D antigen on the red blood cell
- Unlike the AB system, the body does NOT normally produce antibodies against antigen D
- Why is this important? Pregnant females…
- Even when given Rh+ blood, Rh- recipients produced anti-D antibodies only 20% of the time



Hemoglobin & Hematocrit

- Hemoglobin – the amount of hemoglobin in whole blood
  - Males: 14 – 18 g/dL
  - Females: 12 – 16 g/dL

- Hematocrit – volume % of RBCs
  - Males: 40 – 50%
  - Females: 35 – 46%



Blood Administration

Consent

- Obtaining consent is the responsibility of the provider
- The patient has the right to refuse blood or blood products
- In the event of an emergency when consent cannot be obtained, the provider must document the necessity of the transfusion in the patient care report.

Whole blood O neg or O pos

- O neg is preferred. But low supply
  - Universal Donor
  - No risk of isoimmunization
  - Safe for all Patient populations
- O positive is acceptable
  - Based on published STRAC data the risk of isoimmunization of 0.012 and 0.12 patients/year
  - Would take 3000 months (250 years) to have 100 Rh- women of childbearing age receive LTO+WB, and somewhere between 3 and 30 of them would develop isoimmunization without the administration of RhIg
  - Without transfusion of LTO+WB in the prehospital setting over this time period, nearly 500 women of childbearing age would die of hemorrhage

Contraindications for Administering O+ Blood

- Known hypersensitivity to blood transfusions in the past
- Women between the ages of 0-55 whom it cannot be confirmed if they have had a hysterectomy or other procedure that will not allow them to become pregnant.
  - O+ Whole Blood can ONLY be administered to this group with ONLINE MEDICAL CONTROL ONLY from the Receiving Facility.

Blood Component Therapy

- Packed Red Blood Cells (PRBC)
  - O negative
- Fresh Frozen Plasma (FFP)
  - Blood Type and Rh factor not relevant
- Administer one unit of PRBC and one unit of FFP together.
- Reassess and provide additional units if necessary

Interfacility Blood Administration

- Paramedics can initiate and transport blood products with a physician order,
- Blood must be type and crossed for the specific patient
- Consent must be obtained by the paramedic prior to administration
- Blood that has been type and crossed with a physician order does not have to be warmed during administration

During Administration

- Provide normal saline only
- Frequent vital sign checks including temperature
- Monitor for transfusion reactions
- Warm all emergency blood products
- Do not administer medications in the same IV line as blood

Criteria for Administration

Criteria

- Physiological Parameters: Needs to meet 2 parameters:
  - Systolic (SBP) < 90mm Hg
  - Single reading of Heart Rate (HR) >120
  - Shock Index (SI) >0.9
    - HR/SBP=SI
- Signs of significant hemorrhage. - Must be present
- Patients > age of 5 years
- Signs of significant hemorrhage
- Any patient that fall outside these parameters should consult Medical Control.

$$\text{Shock Index} = \frac{\textit{Heart Rate}}{\textit{Systolic Blood Pressure}}$$

Allergic reactions

- Mild-itching, rash, Flushed skin.
- Severe (anaphylaxis)-difficulty breathing.
- Tachycardia
- Hypotension
- Hives
- Anxiety
- Nausea\Vomiting
- Abdominal Pain

Acute hemolytic transfusion reaction

- Rapid destruction of red blood cells that occurs during, immediately after or within 24 hours of a transfusion when patient is given incompatible blood type
- Recipients body begins to destroy donated RBCs
- Sx include:
  - Fever
  - Pain (back, chest)
  - SOB
  - N/V
  - Kidney failure
- Approximately 10% of these reactions are fatal

Febrile

- Temperature elevation of 2 degrees Fahrenheit that occurs up to 4 hours after transfusion.

Transfusion Reactions

- Stop the transfusion
- Remove all tubing and product from the patient
  - Do not discard tubing, bag and leave for receiving facility
- Flush IV line
- Refer to your Anaphylaxis Treatment Guidelines

General Administration Policies

- The administration of blood will follow established standing orders as approved by the Departments medical Control Physician
- If blood is administered the on duty supervisor will be notified and will be responsible for contacting The Blood Connection to have a replacement brought.
- In the event stored product temperature exceeds 6 degrees Celsius the product CANNOT be administered and will be removed from service. Dispose of the unit in a red bag and appropriate container. The On-Duty Supervisor will contact the Blood Connection for replacement.

Logistics

Storage

- Blood must always remain refrigerated unless being transfused.
- The product temperature MUST remain 1 – 6 degrees Celsius with continuous temperature monitoring when stored.
  - Blood must be discarded if the temperature exceeds 6 degrees.
- All storage devices should be validated to hold temperature
- Swap or discard blood per policy

Administration

- Multiple blood and fluid warming devices exist. All paramedics authorized to administration blood must be competent in the department's specific warming devices.
- Blood must be transfused through a blood administration set.

Documentation

- Each unit of blood or blood products have corresponding paperwork. This must be completed and left with the patient and blood bank per policy.
- Each transfusion must also be clearly documented on the patients PCR to include indication, vital signs, and consent.