

Blood Banking & Transfusion Medicine 101

Blood Products and Indications On Why You Would Transfuse Each

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Learning Objectives

After participating in this program you should be able to....

- Describe the main blood products available for transfusion in the United States.
 - Red blood cells
 - Plasma
 - Platelets
 - Cryoprecipitate
 - Whole blood (rarely used in the United States)
- Detail the indications for red blood cell transfusion.
 - To provide oxygenation
- Explain the indications for plasma transfusion.
 - To replace coagulation factors in a bleeding/coagulopathic patient
- Detail the indications for platelet transfusion.
 - To treat/prevent mucosal bleeding in patients with low platelet counts (thrombocytopenic patients)
- Describe the indications for cryoprecipitate transfusion.
 - Main indication is to replace fibrinogen in a bleeding/coagulopathic patient; cryoprecipitate also contains coagulation factors VIII (8) and XIII (13), von Willebrand factor, and fibronectin



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Case 1

- 80 year old woman presents to her primary care physician complaining of shortness of breath and heart palpitations
- Labs today:
 - Hemoglobin: 5.5 g/dL (Normal 13.5 – 17.5 g/dL)
 - Platelet count: 200,000/ μ L (Normal 150,000 – 400,000/ μ L)
 - Coagulation labs: INR 1.1, fibrinogen 200 mg/dL (Normals: INR 0.9 – 1.1; fibrinogen 180-400 mg/dL)
- Hemoglobin six months ago was 9.0 g/dL



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- What blood product may help relieve the patient's symptoms?



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Case 2

- 67 year old man presents to his oncologist for follow-up for his acute myelogenous leukemia
- Since his visit last week, he complains of new tiny purple bruises along his legs and arms and some bleeding of his gums
- Labs show:
 - Hemoglobin: 8 g/dL (Normal 13.5 – 17.5 g/dL)
 - Platelet count: 9000/ μ L (Normal 150,000 – 400,000/ μ L)
 - Coagulation labs: INR 1.0, fibrinogen 250 mg/dL ((Normals: INR 0.9 – 1.1; fibrinogen 180-400 mg/dL)



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- What blood product may help relieve the patient's symptoms?



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Case 3

- A 23 year old man is brought to the emergency room after being hit by a car while riding his bicycle
- He has significant abdominal trauma and is being urgently brought to the operating room
- Labs show:
 - Hemoglobin: 8 g/dL (Normal 13.5 – 17.5 g/dL)
 - Platelet count: 100,000/ μ L (Normal 150,000 – 400,000/ μ L)
 - Coagulation labs: INR 2.0, fibrinogen < 100 mg/dL (Normals: INR 0.9 – 1.1; fibrinogen 180-400 mg/dL)



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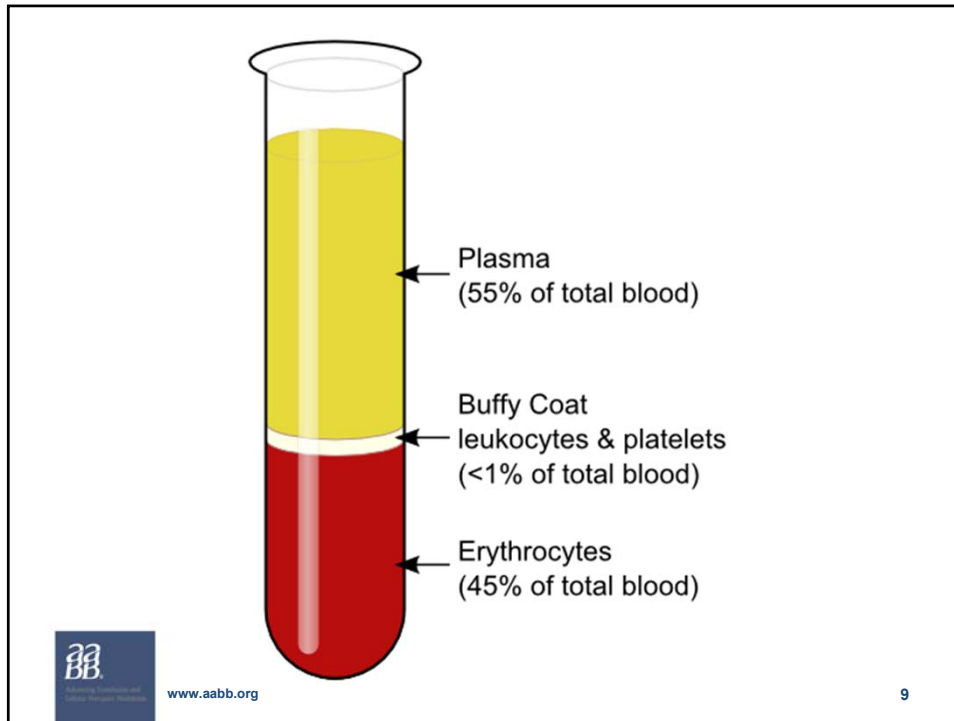
- What blood products may help relieve the patient's symptoms?



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Whole Blood

Donor blood.....	450cc
Red cells.....	200cc
Plasma.....	250cc
Platelets.....	1 "unit"
Anticoagulant (CPDA-1).....	63cc



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Via whole blood donation or apheresis

- Red blood cells
- Plasma
- Platelets
- Cryoprecipitate



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The Family


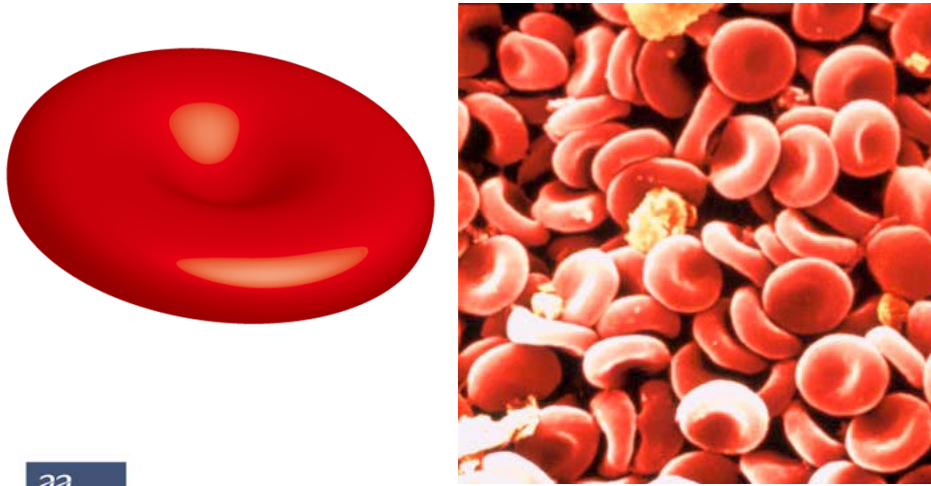


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Red Blood Cells



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Red Blood Cells (RBCs)

- Refrigerator (1-6°C)
- 42 days



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When should RBCs be transfused?

- To increase oxygen-carrying capacity in patients with anemia in whom physiologic compensatory mechanisms are inadequate to maintain normal tissue oxygenation
- As a source of replacement red blood cells during red blood cell exchange
 - Examples: patients with sickle cell anemia, malaria, babesiosis



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*Kaufman RM, Shehata N. (2017). 'Hemotherapy decisions and their outcomes'. In: Fung MK et al (eds.) Technical Manual, 19th ed. AABB:Bethesda, pp.505-507*¹⁵

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What are concerning signs of anemia?

- Hemodynamic instability (shock)
- Chest pain (cardiac-type)
- Shortness of breath
- Tachycardia (increased pulse) at rest

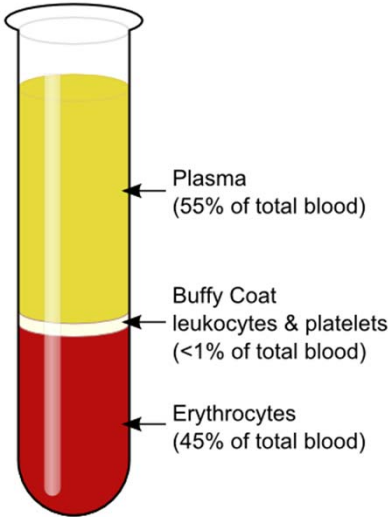


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Plasma



Plasma
(55% of total blood)

Buffy Coat
leukocytes & platelets
(<1% of total blood)

Erythrocytes
(45% of total blood)




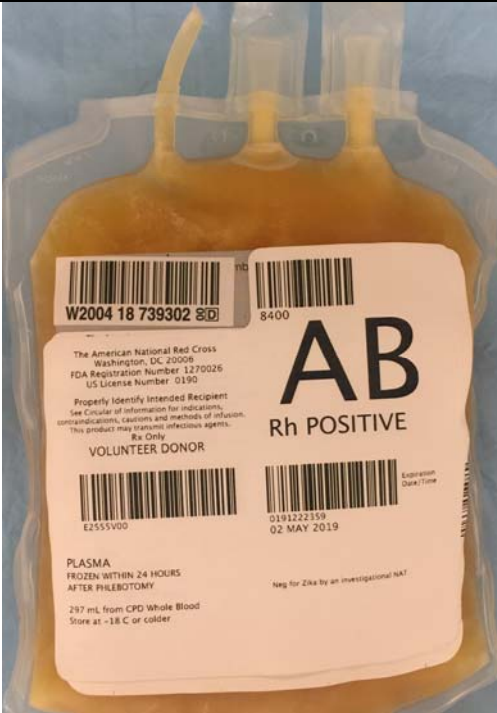
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Plasma

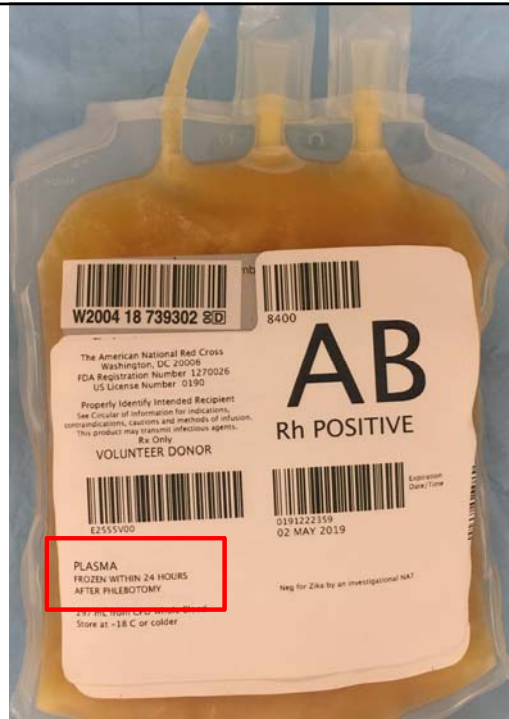
- Stored frozen for up to 1 year
- 5 days at 1-6°C once thawed



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Plasma

- FFP
- PF24
- Thawed plasma
- Solvent/detergent treated plasma



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But which is the best?

- FFP: fresh frozen plasma = plasma frozen within 8 hours of phlebotomy
- PF24 = plasma frozen within 24 hours after phlebotomy
- TP: thawed plasma = one of the above that was thawed and refrigerated at 1-6°C for up to 5 days post-thaw



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But which is the best?

- SD plasma – solvent detergent treated plasma = Pooled from many donors of the same ABO type and treated with pathogen inactivation methods
- In the USA, available from Octapharma as Octaplas®, Pooled Plasma (Human), Solvent/Detergent Treated Solution for Intravenous Infusion.



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When should plasma be transfused?

- To treat bleeding in patient with multiple coagulation factor deficiencies
- To treat and prevent bleeding in patients with specific plasma protein deficiencies for which a specific factor concentrate does not exist
- In massive transfusion protocols with other blood products
- To reverse anticoagulation effects of warfarin



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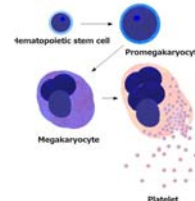
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Platelets



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What are platelets?



- Anuclear cells produced by bone marrow
- Survive for ~ 10 days once released from the bone marrow
- Smaller than a red blood cell
- Normal platelet count in a healthy adult is between 150,000 and 400,000/ μ L
- People make on average 35,000 to 44,000 platelets/ μ L per day



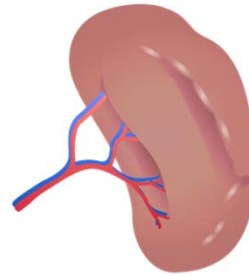
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What do platelets do?

- 2/3 are in the general circulation
- 1/3 are in the spleen
- Vital to cell-based hemostasis (clotting)



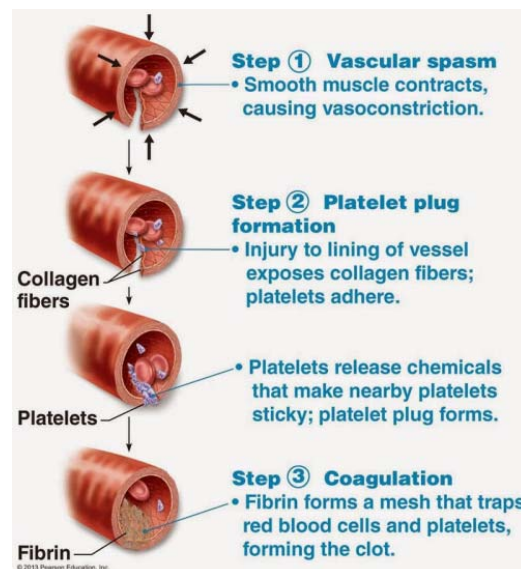
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Clotting



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When should platelets be transfused?

- To prevent bleeding in patients with thrombocytopenia from chemotherapy
- To prevent bleeding prior to invasive procedures (not good evidence at all)
- To treat active bleeding along with other blood products



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Cryoprecipitate (aka Cryo)

- Stored frozen for a year
- Once thawed, store 20-24°C for 6 hours



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What does cryo have?

- Derived from plasma
- Contains fibrinogen, Factor VIII, Factor XIII, von Willebrand Factor and fibronectin



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When should cryo be transfused?

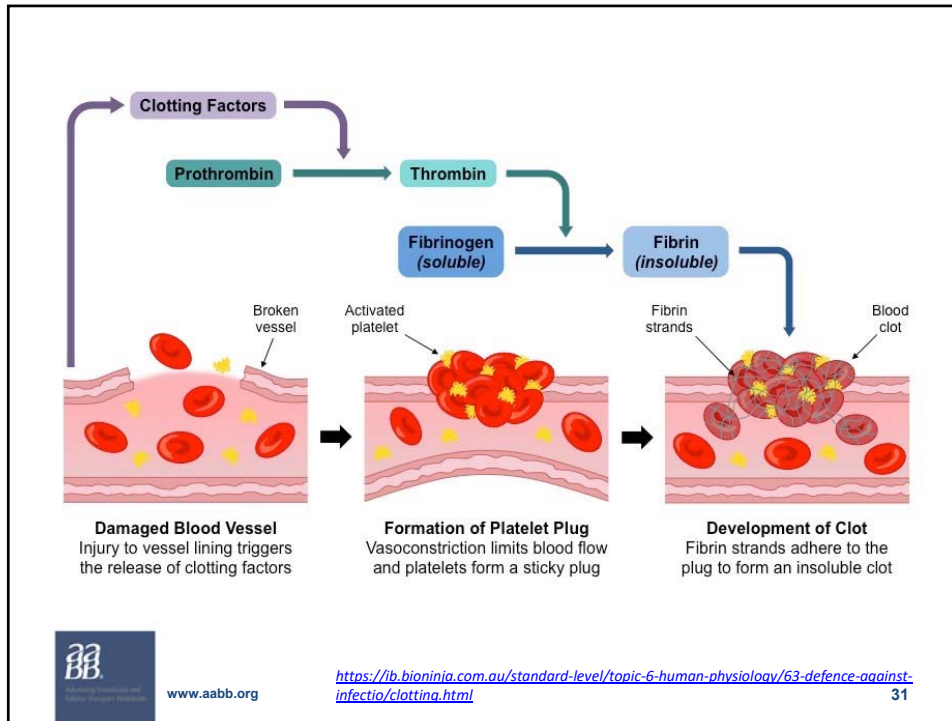
- To replace fibrinogen in patients with acquired hypofibrinogenemia who are bleeding or having an invasive procedure
- Given to adults as a pool(s) from 10 total donors
 - 1 dose will raise fibrinogen level by 75-100 mg/dL



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Additional products your Blood Bank may have

- HLA matched platelets
- Granulocytes
- Factor concentrates – human and recombinant
 - rFVIIa
 - Kcentra
 - Recombinant FVIII and FIX
 - Humate
 - Thrombate
 - Rh immune globulin
 - Fibrinogen concentrate
- Intravenous immune globulin (IVIG)



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Fibrinogen concentrate

RiaSTAP[®]
Fibrinogen Concentrate (Human)



- Human plasma derived product intended for fibrinogen replacement
- Only FDA approved for treatment of bleeding in patients with congenital fibrinogen deficiency
- Dosing is based on fibrinogen level and patient weight
- More expensive than cryoprecipitate
- Not available at all hospitals



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Back to the cases



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Case 1

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- What blood product may help relieve the patient's symptoms?
 - Packed red blood cells



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Case 2

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- What blood product may help relieve the patient's symptoms?
 - Platelets



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Case 3

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- What blood product may help relieve the patient's symptoms?
 - Packed red blood cells
 - Plasma
 - Platelets
 - Cryoprecipitate



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You've made it to the end.....



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Final Thoughts

- Describe the products available for transfusion in the US
 - Red blood cells
 - Plasma
 - Platelets
 - Cryoprecipitate
- Detail indications for each blood product
- Discuss the conclusion of each presented clinical case



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Questions?

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