Blood Under Pressure

Trace how blood components and ABO types affect transfusions

HAP.9 "Students will analyze the structure and functions of blood and its role in maintaining homeostasis. Describe the structure, function, and origin of the cellular components and plasma components of blood..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each blood component and its job. Circle the ABO antigens and antibodies, then number the steps that explain how an unsafe transfusion can cause harm.

More Than Replacing Blood

1. When a patient loses blood, restoring its volume is only part of the problem. Plasma, the liquid portion, carries water, dissolved nutrients, hormones, and proteins. Albumin helps keep water in blood vessels, while clotting proteins help stop bleeding. Red blood cells carry oxygen using hemoglobin. They develop from stem cells in red bone marrow, then lose their nuclei as they mature. White blood cells also arise from marrow stem cells and defend against infection. Platelets are cell fragments shed by marrow cells called megakaryocytes; they help form clots. Together, these parts support a stable internal environment.

2. A red blood cell's surface may carry A antigens, B antigens, both, or neither. These patterns define types A, B, AB, and O, respectively. Type A plasma normally has anti-B antibodies; type B plasma has anti-A; type O plasma has both; type AB plasma has neither. In a blood typing test, a sample's red cells are mixed separately with anti-A and anti-B testing antibodies. Clumping with one reagent means the matching antigen is present. For a packed red cell transfusion, donor cells must not carry A or B antigens that the recipient's plasma antibodies would attack.

3. Consider a patient whose marrow cannot make enough healthy red blood cells. This anemia can reduce oxygen delivery, leaving the patient tired and short of breath even when blood volume is normal. A clinician may consider packed red cells if the anemia is severe, but the wrong ABO match creates another danger. Recipient antibodies can bind to donor red cells, causing clumping and destruction of those cells. This reaction may harm the kidneys and disrupt circulation instead of restoring oxygen delivery. Compatibility therefore depends on surface antigens and plasma antibodies, not simply on how much blood a person needs.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the red blood cells' origin and function help explain why severe anemia can reduce oxygen delivery even when blood volume is normal?

2. A blood sample clumps with anti-A testing antibodies but not with anti-B. What is its ABO type, and which antibody does its plasma normally contain?

3. Can a type A patient receive packed red cells from a type AB donor? Explain using the donor's antigens and the recipient's antibodies.

4. How could an ABO-mismatched transfusion worsen a patient's condition instead of improving oxygen delivery?

3 YOUR TURN

Your own words

A patient with severe anemia has red cells that clump with both anti-A and anti-B testing antibodies. The clinic has type A and type B packed red cell units. In three or four sentences, identify the patient's type, evaluate both units using antigens and antibodies, and explain how a compatible unit could help.

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PART 1 · READ AND MARK

Underline each blood component and its job. Circle the ABO antigens and antibodies, then number the steps that explain how an unsafe transfusion can cause harm. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the red blood cells' origin and function help explain why severe anemia can reduce oxygen delivery even when blood volume is normal?	**Red blood cells develop in red bone marrow and carry oxygen using hemoglobin. If the marrow makes too few healthy red cells, less oxygen can be delivered despite normal blood volume.**
2	A blood sample clumps with anti-A testing antibodies but not with anti-B. What is its ABO type, and which antibody does its plasma normally contain?	**It is type A, and its plasma normally contains anti-B antibodies.**
3	Can a type A patient receive packed red cells from a type AB donor? Explain using the donor's antigens and the recipient's antibodies.	**No. Type AB donor cells carry B antigens, which the type A recipient's anti-B antibodies would attack.**
4	How could an ABO-mismatched transfusion worsen a patient's condition instead of improving oxygen delivery?	**Recipient antibodies can bind to donor red cells, causing clumping and cell destruction. The reaction can harm the kidneys and disrupt circulation instead of restoring oxygen delivery.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Clumping with both testing antibodies shows that the patient has type AB red cells. Type AB plasma has neither anti-A nor anti-B antibodies, so both the type A and type B packed red cell units are ABO compatible. A compatible unit can increase the number of red cells carrying oxygen, which may ease symptoms caused by severe anemia.

Evaluate compatibility for packed red cells using ABO antigens and the recipient's plasma antibodies. The passage does not address Rh type or other transfusion requirements.