

Review: Blood Specimen Handling & Cardiovascular System

Blood Specimen Handling

Proper blood specimen handling is critical to ensure accurate laboratory results and patient safety. Errors during collection, labeling, or transport can cause hemolysis, clotting, or contamination, leading to rejected samples or false results.

Hemolysis Causes and Prevention

Hemolysis can occur from shaking tubes vigorously, using small needles, or collecting blood too quickly. Always use gentle inversion to mix additives (never shake), and allow the alcohol to dry before venipuncture to avoid cell lysis.

Tube Additives and Functions

- **Lavender-top (EDTA):** Prevents clotting by binding calcium; used for CBCs and hematology.
- **Light-blue top (Sodium citrate):** Used for coagulation studies; must be filled completely for the correct blood-to-additive ratio.
- **Green-top (Heparin):** Prevents clotting by inhibiting thrombin; used for plasma and chemistry tests.
- **Gray-top (Sodium fluoride/potassium oxalate):** Used for glucose testing; prevents glycolysis.

Handling and Storage

Tubes must be inverted gently 5–10 times after collection to ensure complete mixing with additives. Specimens requiring centrifugation should be spun **after clotting is complete**, not immediately after collection. Delayed processing can cause hemolysis or chemical changes, such as decreased glucose and increased potassium.

Special Handling Requirements

- **Cold agglutinin tests:** Must be kept warm (37°C) after collection.
- **Chilled specimens (e.g., ammonia, lactic acid):** Should be transported on ice.
- **Light-sensitive tests (e.g., bilirubin):** Must be protected from light.

Specimen Rejection Reasons

- Hemolyzed or clotted samples
- Incorrect tube or additive
- Underfilled light-blue top tube
- Mislabeled specimens
- Prolonged delay before processing

Cardiovascular System

The cardiovascular system circulates blood throughout the body, delivering oxygen and nutrients while removing waste. It includes the **heart, blood vessels, and blood**.

Heart Structure and Blood Flow Pathway

1. Blood enters the **right atrium** from the superior and inferior vena cava.
2. It passes through the **tricuspid valve** into the **right ventricle**.
3. From the right ventricle, it flows through the **pulmonary valve** into the **pulmonary arteries** and then to the **lungs** for oxygenation.
4. Oxygenated blood returns via the **pulmonary veins** to the **left atrium**.
5. It flows through the **mitral (bicuspid) valve** into the **left ventricle**, which pumps it through the **aortic valve** into the **aorta** and throughout the body.

Superior vena cava → Right atrium → Tricuspid valve → Right ventricle → Pulmonary valve → Pulmonary arteries → Lungs → Pulmonary veins → Left atrium → Mitral valve → Left ventricle → Aortic valve → Aorta.

Key Heart Valves and Functions

- **Tricuspid Valve:** Prevents backflow into the right atrium.
- **Pulmonary Valve:** Prevents backflow into the right ventricle.
- **Mitral (Bicuspid) Valve:** Prevents backflow into the left atrium.
- **Aortic Valve:** Prevents backflow into the left ventricle.

Major Veins for Venipuncture

- **Median Cubital Vein:** Most commonly used; centrally located and stable.
- **Cephalic Vein:** Used when the median cubital is not accessible.
- **Basilic Vein:** Used with caution due to proximity to nerves and arteries.

Capillary and Venous Blood Differences

Capillary blood is more arterial in nature—richer in oxygen—and is used when venipuncture is not suitable, such as for newborns or fragile veins.

Cardiovascular and Phlebotomy Connection

Understanding cardiovascular anatomy helps in identifying safe venipuncture sites, recognizing complications (like hitting a nerve or artery), and ensuring correct sample handling for cardiac-related tests (e.g., troponin, CK-MB).

Preanalytical Factors Affecting Cardiac Tests

Hemolysis, delayed processing, or improper handling can falsely elevate cardiac enzymes. Samples should be drawn gently, processed quickly, and kept at recommended temperatures.

Summary Tips

- Always verify patient identification and tube labeling before leaving the patient's side.
- Know the **order of draw** to prevent additive contamination.
- Understand how the **heart's structure** affects blood flow and specimen source.
- Prevent hemolysis, clotting, and contamination with careful technique.
- Follow all storage and transport requirements for accurate results.

Mastering these areas ensures accurate specimen quality, reduces lab errors, and strengthens your understanding of how the cardiovascular system supports diagnostic testing.