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## What Is Hemolysis?

Hemolysis is the breakage of the red blood cell's (RBC's) membrane, causing the release of the hemoglobin and other internal components into the surrounding fluid. Hemolysis is visually detected by showing a pink to red tinge in serum or plasma.<sup>1</sup> Hemolysis is a common occurrence seen in serum samples and may compromise the laboratory's test parameters. Hemolysis can occur from two sources:

- In-vivo hemolysis may be due to pathological conditions, such as autoimmune hemolytic anemia or transfusion reaction.<sup>1</sup>
- In-vitro hemolysis may be due to improper specimen collection, specimen processing, or specimen transport.

## What Are The Causes?

### **Specimen Collection:**

#### *Evacuated Tubes*

- An improper choice in the venipuncture site, such as drawing from a distal site to the antecubital region of the arm rather than drawing from an antecubital site, has been shown to result in more hemolysis.<sup>2</sup>
- Prolonged tourniquet time causes the interstitial fluid to leak into the tissue and cause hemolysis.<sup>2</sup>
- Cleansing the venipuncture site with alcohol and not allowing the site to dry may cause hemolysis.<sup>3</sup>
- An improper venipuncture, indicated by a slow blood flow, may indicate occlusion due to the lumen of the needle being too close to the inner wall of the vein, causing hemolysis.<sup>4</sup>
- The use of a small-bore needle, resulting in a large vacuum force applied to the blood, may cause shear stress on the red blood cells, causing them to rupture.<sup>1, 5, 6</sup>
- The use of a large bore needle may result in a much faster and more forceful flow of blood through the needle, resulting in hemolysis.<sup>1, 7</sup>

#### *Syringe Draws*

- Pulling the plunger of a syringe back too far while using a large bore needle, may cause enough pressure for hemolysis to result during collection. The pressure may be greater than a standardized evacuated tube.
- Transferring into a tube by pushing down on the syringe plunger in order to force blood into a tube may cause hemolysis, as well as create a positive pressure in the tube which may cause the stopper to come off.

#### *IV Catheters*

- Several studies have noted that when blood is drawn from a peripheral IV catheter, a higher incidence of hemolysis occurs due to frothing of the blood from a loose connection of the blood collection assemblies.<sup>1, 8</sup>

### **Specimen Processing:**

- Vigorous mixing or shaking of a specimen may cause hemolysis.
- Not allowing the serum specimen to clot for the recommended amount of time can result in fibrin formation in the serum. The use of applicator sticks to dislodge the fibrin may cause rupture of RBCs, resulting in hemolysis.<sup>1, 5</sup>
- Prolonged contact of serum or plasma with cells may result in hemolysis.<sup>9</sup>
- Exposure to excessive heat or cold can cause RBC rupture and hemolysis.<sup>10</sup>

### **Specimen Transport:**

- Mechanical trauma during transport may occur with the use of a pneumatic tube system, resulting in hemolysis. Variable factors associated with the system are related to system differences such as length, speed, and number of times the specimen is transported, as well as the number of angles or turns the system uses.<sup>2</sup>

# What Are The Effects Of Hemolysis?

Test results from all laboratory disciplines can be affected by hemolysis, especially in chemistry. Hemolysis may cause certain analytes to be increased due to leakage of red cell constituents (e.g., lactate dehydrogenase and potassium), or may cause interference in the test method (e.g., spectrophotometric methods). The amount of interference will depend on the degree of hemolysis and on the specific test method being used. Hemolysis is a common cause of specimen rejection in laboratories, which requires the specimen to be redrawn.<sup>5,10,11,12, 13</sup>

## Corrective Actions

- Redraw the specimen.
- The most common sites to draw from are the median cubital, basilic, and cephalic veins from the antecubital region of the arm.
- The choice of the needle gauge size is dependent on the patient's physical characteristics and the amount of blood to be drawn. The most commonly used sizes are 19 through 23. Avoid using a needle that is too small or too large.
- The tourniquet should be released after no more than one minute, and excessive fist clenching should be avoided.
- Without touching, allow the venipuncture site to air dry.
- Avoid drawing the syringe plunger back too forcefully when collecting blood with a needle and syringe.
- Avoid pushing the plunger too forcefully when transferring to a tube.
- Ensure all blood collection assemblies are fitted securely, to avoid frothing.
- Gently invert the blood collection tube and mix additive specimens thoroughly according to manufacturers' recommendations.
  - Invert specimen with a clot activator 5 times to ensure the distribution of the clot activator within the sample, and allow the specimen to clot for a full 30 min. in a vertical position.
  - Serum tubes without clot activator should be allowed to clot for 60 min. in a vertical position.
  - Sodium citrate tubes for coagulation testing should be inverted 3-4 times.
  - All other anticoagulant tubes should be inverted 8-10 times.<sup>3</sup>

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