Hemolysis: The Most Common Source of Specimen Rejection

Hemolyzed specimens are the most common source of specimen rejection, accounting for approximately 60% of rejected specimens.

Defined as red blood cell breakdown and the release of hemoglobin and intracellular contents into the plasma, hemolysis can seriously impact patient care and a laboratory's reputation by adversely affecting test results (e.g., decrease in potassium, lactate dehydrogenase, aspartate aminotransferase, magnesium and increase in lipase and iron). Hemolysis may occur *in vivo* or *in vitro*.

Multiple medical conditions, such as hemolytic anemia and hemodialysis, can cause hemolysis *in vivo*. Factors affecting hemolysis *in vitro* can occur at the patient's bedside and continue through analysis and storage. These factors may vary depending upon the patient's condition (fragile veins), the skill of the person collecting the sample (training), and environment (temperature, length of transport).

The major causes of hemolysis are improper specimen collection and handling. (These procedures are normally not under the control of the laboratory; yet, rejected samples and inaccurate test results are often attributed to laboratory errors). Training and skills are essential to collect a quality specimen that produces accurate results.

Collecting data in your healthcare institution can help identify the areas **where** hemolysis occurs most frequently (emergency room, intensive care unit, maternity); this, in turn, can guide further analysis about **why** it is occurring. Once these elements are known, best practices and training can be implemented to dramatically reduce hemolysis and avoid erroneous laboratory results that may impact patient care and increase laboratory costs.

Practices to Reduce *In Vitro* Hemolysis:

- Carefully review practices and procedures when collecting blood samples from patients with fragile veins, such as geriatric and oncology patients.
- Carefully review practices and procedures when collecting blood samples from catheterized patients (e.g., in emergency, intensive care, and maternity departments).
- Key aspects during collection: Avoid collection from a hematoma site, prolonged tourniquet time, and equipment and connections that may lead to turbulent blood flow; use appropriate techniques for syringe collection; ensure appropriate volume collected; avoid vigorous mixing.
- Define practices for sample transportation to preserve appropriate temperature, and to avoid prolonged transportation time and excessive sample agitation.
- Centrifuge within an appropriate time of collection; aliquot supernatant (serum or plasma) from red cells unless using a gel-based separator tube.
- Ensure appropriate centrifugation conditions, specifically g force, spin time and temperature.

- Review patient history for factors that may affect *in vivo* hemolysis: metabolic disorders (liver disease, sickle cell anemia), drugs (analgesics, antimalarial drugs), hemolytic anemia, third degree burns and infections.
- When possible, use analytical methods that are not affected by hemolysis.
- Consider using instrument features, such as hemolysis index, to determine the level of hemolysis in samples. This can be used to monitor sample quality over time and provide information about areas for improvement.

Resources:

- Causes, consequences and management of sample hemolysis. Heireman L, Van Geel P, et al. Clin Biochem 2017;50:1317-1322.
- Hemolysis rates in blood samples: differences between blood collected by clinicians and nurses and the effect of phlebotomy training. Cadamuro J, von Meyer A, et al. Clin Chem Lab Med 2016;aop.
- Influence of hemolysis on routine clinical chemistry testing. Lippi G, Salvagno GL, et al. Clin Chem Lab Med 2006;44:311-316.
- Hemolytic index; a tool to measure hemolysis *in vitro*. Adiga U, Yogish S. J Biotech Biochem 2016;2:49-52.
- Hemolyzed specimens: Major challenge for identifying and rejecting specimens in clinical laboratories. Azman W, Omar J, et al. Oman Med J 2019;34:94-98.
- CLSI. Collection of Diagnostic Venous Blood Specimens. 7th ed. CLSI Standard GP41. Wayne, PA: Clinical and Laboratory Standards Institute; 2017.
- CLSI. Procedures for the Handling and Processing of Blood Samples for Common Laboratory Tests; Approved Guideline-Fourth Edition. CLSI document H18-A4. Wayne, PA: Clinical and Laboratory Standards Institute; 2010.