PRE-ANALYTICAL VARIABLES

A number of factors can influence sample results in coagulation testing  
By Lindsey Nolen
Although modern laboratory procedures are typically thought to yield high levels of test reliability, outside factors have the potential to impact results. These pre-analytical variables, which can include discrepancies within blood sample collection and processing, occasionally generate either incorrect or inappropriate test results. In fact, pre-analytical variables have accounted for 64% of all errors in lab testing. For this reason, it is critical that laboratory professionals and clinicians predetermine all possible contributory factors in an effort to minimize or prevent fraudulent clinical findings.

Influential Factors
A number of variables can affect a blood sample’s overall quality. These factors may include poor veins, insufficient mixing of the sample or an interruption of blood flow during the collection process. When one or all of these variables are presented, the results can show increased sample clotting or activation of the coagulation cascade, leading a clinician to conclude abnormal in vitro clotting results.

A product of increased muscle activity, when a patient is seen opening and closing his or her fist during the collection of a blood sample, can spark a rise in both potassium and magnesium, leading to inaccurate results. This outcome has been known to occur due to excessive constriction during collection as well.

According to SelectScience, other factors such as exercise, eating, drinking and medication can also affect patient results. For example, eating and drinking can impact levels of glucose, triglycerides, alkaline phosphatase, alanine, aminotransferase, inorganic phosphate, cholesterol, folic acid, urea, potassium and other elements within the body.

This is why it is usually recommended that a patient fast before blood samples such as those designed to test for creatine kinase, aspartate aminotransferase or lactate dehydrogenase. The same fasting approach can also be suggested in the case of certain medications, unless a blood test is requested specifically for therapeutic drug monitoring purposes.

“Under-filling a tube is [another] common problem that can cause coagulation results to be falsely elevated. All coagulation tubes must be filled to at least 90% of capacity. Those that are submitted but under-filled must be rejected by the testing personnel,” explained Dennis J. Ernst, MT(ASCP), executive director at the Center for Phlebotomy Education, Inc. “There are two points in which this error occurs. The first one is when the collector submits an under-filled tube instead of recollecting it while at the patient’s side. The second is when the testing personnel fail to reject an under-filled tube.”

New Technology
Although most laboratory personnel are trained to be able to identify potential problems throughout testing, diagnostic manufacturers are now developing new technologies that enable the analyzer itself to flag all possible pre-analytical factors. Sphere Medical has launched a near patient testing blood gas analyzer designed to address common pre-analytical red flags. This device can identify errors like sedimentation rates, hemolysis and sample contamination.

Another modern diagnostic technology, automated systems such as Beckman Coulter’s Power Processor Sample Handling System, has proven to reduce the risk of human error. These systems can revolutionize a lab’s entire operation, enhancing productivity, operator safety and accuracy, as well as significantly reduce labor costs and eliminate opportunities for errors for improved patient safety.

Test Evolution
According to the 2008 publication, Laboratory Medicine: A National Status Report, produced by the Lewin Group, an INGENIX company, laboratory test selection errors may also arise because clinicians lack adequate knowledge for decision-making when ordering complex testing regimens.

The report went on to assert that a clinician’s knowledge and ability to appropriately order tests is often complicated by the rapid proliferation of new tests. According to the report, there are more than 4,000 different laboratory tests now on the market, including some new genetic tests that can be used for an estimated 1,430 diseases. With so many recent advances in biochemical, molecular and genetic sciences, it is often hard to stay up-to-date on all the new avenues of laboratory diagnostics for clinical use.

Staying Educated
Not being able to maintain an adequate level of education and expertise to deal with the overload of new clinical information is dangerous when clinicians are
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4. Laboratory Medicine. Pre-analytical Variables in Coagulation Testing Associated With Diagnostic Errors in Hemostasis. Available at: http://goo.gl/5iWEXZ

While the presence of molecular diagnostics is growing across the industry, coagulation and hematology, especially in regards to hemophilia and clotting disorders, remain essential to clinical laboratory science. http://laboratory-manager.advanceweb.com/Features/Articles/MDx-and-Coag.aspx

the ones ordering and conducting most laboratory tests on patients. Widely overlooked from a training perspective, few clinicians or laboratory professionals receive formal training in maintaining effective diagnostic communications.

“Physicians receive very little training in the effects of pre-analytical errors in medical school. The great majority of training they likely receive is that which they learn from laboratorians who articulate the nuances of pre-analytical physiology in the workplace,” commented Ernst.

The Lewin Group’s report noted that medical students are exposed to only 29 hours of didactic coursework in medical genetics on average. The increased breadth and complexity in genetics blood work makes it difficult for these clinicians to remain informed without having acquired the appropriate education. As medical and scientific advancements in the field continue to expand, this lack of education poses serious threats to a clinician’s ability to perform the designated tests and could lead to sub-standard quality medical care or even medical malpractice.

Overall, it is extremely important that clinicians learn how to best reduce the risk of preanalytical errors prior to conducting coagulation tests. During the process of patient testing, there are many opportunities for pre-analytical errors to occur. In order to maintain reliable and accurate results, clinicians must stay up-to-date on all related information and advances in diagnostic technologies.

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