

ARTERIAL BLOOD GASES

Beyond Traditional Analytes- Coagulation Studies

by Susan Blonshine BS, RRT, RPFT

Expanding our scope of practice beyond the traditional boundaries of arterial blood gases (ABGs) presents new opportunities to respiratory therapists in other areas of clinical laboratory testing, such as coagulation studies. Coagulation studies include the measurement of prothrombin time (PT), activated partial thromboplastin time (APTT), and activated coagulation time. PT is the most common coagulation study performed in the clinical laboratory. Indications for use include diagnosis of hemostatic disorders and monitoring of anticoagulation therapies.

Defining coagulation analytes

PT is used to evaluate the extrinsic and common coagulation pathway along with the mon-

itoring of oral coagulation therapy. The results are expressed in seconds representing the time required for a fibrin clot to form after tissue thromboplastin and calcium chloride have been added to the sample. APTT is used to evaluate the intrinsic and common coagulation pathway along with the monitoring of therapy with unfractionated heparin and certain other coagulants. The results are expressed in seconds representing the time required for a fibrin clot to form in a plasma sample after calcium chloride, a partial thromboplastin reagent, and a contact factor activating agent have been added to the sample.

Pre-analytical considerations

The pre-analytical issues are different for coagulation studies

versus ABGs. The validity of both PT and APTT results are strongly affected by pre-analytical and analytical factors. The variables that may impact the test results include the concentration and amount of anticoagulant, specimen storage time and temperature, the surface of the storage, or transport containers.

Preventing hemolysis of the sample during the draw is an important consideration. An increased risk of hemolysis may occur with smaller needle sizes and air leaks in catheter systems. Lines that are flushed with heparin should be avoided as draw sites. If the draw must be obtained from the catheter, six dead-space volumes of the catheter should be discarded. When collecting multiple specimens from one site, the coagulation specimen should

be collected in the second or third tube.

Careful attention to the anticoagulant and the anticoagulant/blood ratio is required for valid test results. The National Committee for Clinical Laboratory Standards (NCCLS) guidelines recommends an anticoagulant of 105–109 mmol/L, 3.13–3.2 percent dihydrate form of trisodium citrate, buffered or nonbuffered with a nine-to-one anticoagulant/blood ratio.¹ Citrate volume may need to be adjusted for patients with high-packed cell volume. Adherence to the recommended techniques is required to improve precision and accuracy within and among laboratories.

Specimens arriving in the laboratory or analyzed at point of

care should be reviewed and inspected for rejection criteria. If the specimen is clotted or collected in the wrong anticoagulant, or if the volume is inadequate, the specimen is not suitable for analysis. Gentle inversion and observation of the specimen is performed to assess the sample for clot formation.

Preventing analytical errors

Analytical errors are influenced by the reagents, instruments, sample delivery devices, and timer. Reagent-related problems may include contaminated reagents, reconstitution with the incorrect diluent volume or the wrong diluent, mishandling of the reagent in shipping or stor-

references

1. National Committee for Clinical Laboratory Standards (NCCLS). (1998). *Collection, transport, and processing of blood specimens for coagulation testing and general performance of coagulation assays; approved guideline* (3rd ed.). Wayne, PA. (NCCLS Document H21-A3).
2. NCCLS. (1996). *One-stage prothrombin time (PT) test and activated partial thromboplastin time (APTT) test; approved guideline*. Wayne, PA. (NCCLS Document H47-A).
3. Despotis, G.J., Joist, J.H., & Goodnough, L.T. (1997). Monitoring of hemostasis in cardiac surgical patients: impact of point-of-care testing on blood loss and transfusion outcomes. *Clinical Chemistry*, 43(9), 1684-1696.

age, or use beyond the stated stability date or expiration date.²

Additional errors may occur if the incubation time or activation time is incorrect. Instrument-operating procedures must always be followed to prevent analytical errors. Instrument malfunctions may be caused by defective bulbs, incorrect temperature, reagent splash, poor reagent delivery, or electrical interferences.² Under normal day-to-day conditions using the same lot of normal and abnormal control plasma, the coefficient of variation for the analytic system should not exceed 5 percent.

Similar to ABGs, quality control and proficiency testing is required. Additional record keeping requires maintaining lot numbers of reagents, reference materials, and blood collection devices.

PT report standardization

The reporting of PT results has been standardized with the use of the International Normalized Ratio (INR). The INR is the PT ratio obtained using the World Health Organization international reference preparation as the source of thromboplastin in the performance of PT.

Further information and an explanation of the international sensitivity index may be found in the NCCLS guidelines.

Expanding our scope of practice

Coagulation studies may be performed in multiple settings, including the emergency department, critical care, extracorporeal membrane oxygenation, subacute care, bronchoscopy, catheterization lab-

oratories, hemodialysis, surgery department, and home care setting.

A 1997 study from the Washington University School of Medicine in St. Louis, MO, demonstrated that point-of-care coagulation studies dramatically improved patient outcomes and length of stay in certain situations.³

Adding coagulation studies to the respiratory therapist's responsibilities provides us with another opportunity to impact quality of care and health care costs in partnership with clinical laboratories. 🧠

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