

Arterial Blood Gas Analysis: Preanalytical Concerns

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The results you obtain from the blood gas analyzer are only as good as the sample that is introduced into the system. For accurate results, and to avoid clotting, utilize blood collection devices with electrolyte-balanced lyophilized heparin. Once the sample is obtained, immediately expel the air. Mix the sample thoroughly after drawing and again before analysis. Analyze as soon as possible after patient draw.

1 Sample Contamination with Room Air



The presence of air in a syringe sample will affect the pO_2 , especially when the sample is mixed. Any air present must be expelled immediately after collection. Even a few small bubbles left in the sample will significantly distort the pO_2 .

Exposure to room air can also affect pH and pCO_2 results.

4 Settling of Red Blood Cells

Red blood cells settle very quickly in anticoagulated blood when the sampling device is left to rest. If settling has occurred, the analyzer will aspirate too many or too few red blood cells. In particular, this can affect the total hemoglobin result.

If a sample is not analyzed within 30 seconds of mixing, it must be remixed before analysis.

5 Dilutional Errors

If the sample is drawn from an arterial line that has not been fully cleared or from too close to an infusion site, or if liquid heparin is used, the results will reflect sample contamination from these fluids. All results may be affected, depending on the contaminating fluid, but glucose, potassium, and sodium are the most affected parameters.

Note: You cannot see fluid contamination. When mixed, the contaminated sample looks like whole blood.

6 Errors from Delayed Analysis

A whole blood sample is a piece of living tissue. The white blood cells will continue to use O_2 and produce CO_2 , and they also utilize the glucose in the sample and create lactate as a metabolized by-product. For the sample to accurately reflect the status of the patient, it should be analyzed immediately; otherwise, cell metabolism will begin to alter the test results for the sample. The sample may be stored at room temperature for up to 30 minutes prior to analysis.

Parameters affected by ongoing cellular metabolism:

pO_2	↓ due to consumption by cells
pCO_2	↑ due to production by cells
pH	↓ due to change in CO_2 and glycolysis
Glucose	↓ due to cellular metabolism
Lactate	↑ due to glycolysis

If a delay of more than 30 minutes occurs before analysis, consider storage in ice water, and recognize the possibility of hemolysis resulting in elevated potassium levels.

2 Clotting

The fluidic channels in the blood gas analyzer can be blocked by sample clots. Whole blood must be fully mixed with appropriate anticoagulants to minimize the negative effect that clots may have on analyzer performance.



Mix the sample as soon as possible after collection to distribute the heparin throughout the sample. Ensure that you use the correct sampling device, and mix the anticoagulant thoroughly by rolling the syringe between your palms at least 20 times or for a minimum of 1 minute. Take care to avoid warming the sample.

Never use a noticeably clotted sample on your blood gas system.

3 Hemolysis

If blood is withdrawn under force, or through a very small needle bore, the red blood cells may hemolyze (break), releasing their contents.

Note: Small amounts of hemolysis can elevate the potassium level significantly. You cannot identify hemolysis in whole blood; however, hemolysis is easy to recognize visually in plasma or serum samples.

References:

1. CLSI C46-A2: Blood Gas and pH Analysis and Related Measurements; Approved Guideline, 2nd Edition.
2. CLSI H11-A4: Procedures for the Collection of Arterial Blood Specimens; Approved Standard, 4th Edition.