ARTERIAL BLOOD GAS ANALYSIS:

Answering Age-Old Questions

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Over the years, there are some questions that are frequently asked; and so we continue to search for the best answers. This holds true for arterial blood analysis and hemoximetry. Revisiting a few of these age-old questions reminds us of the need for continuing education and research and of the complexity of the problems. A few of these common questions include measurement of pleural pH, measurement errors with CO-oximetry, and quality control (QC).

Measuring pleural pH

Although the blood gas analyzer (BGA) may be considered the "gold standard" for measurement of pleural pH, the question of using this instrument continues to be asked in light of CLIA '88 regulations and test complexity issues. Several researchers have compared the use and accuracy of methods for determining pleural pH.

Chandler and colleagues[1] questioned 277 acute centers concerning the various methods for measuring pleural pH. They found three selected techniques including the BGA (32 percent), dip stick or pH indicator paper (56 percent), and a pH meter (12 percent). Subsequently, Chandler et al analyzed consecutive samples of exudative pleural fluid by all three methods. The study results revealed a mean difference of 0.16 pH unit between the BGA and other methods. As testing was delayed, the pH was increasingly alkalotic and more variable. The authors concluded that the BGA should be used if accurate measurements were required to guide therapy.

Chandler's findings support an earlier study in 1998 comparing the BGA, pH meter, and pH indicator strip. The authors had concluded that if pH is used for clinical decisions, only values provided by the BGA are sufficiently accurate.[2] Although it may be cost effective to use pH paper, the reliability of the results makes it an unreasonable alternative to the BGA.[3]

CO-oximetry measurement errors

Hemoximetry results are dependent on the measured changes in light absorption from variations in the relative concentrations of the dyshemoglobins. Egan's "Fundamentals of Respiratory Care" outlines several problems that may interfere with the measurements.[4] Methemoglobinemia and its treatment with methylene blue are two often-overlooked examples of such problems. Nitrite poisoning is the most common cause of methe-

references

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moglobinemia. Acute methemoglobinemia has also been reported after taking sulfa-containing medications.

A 1997 study suggested that when methemoglobin results exceed 9 percent, significant discrepancies in CO-oximetry measurements exist.[5] Other problems that may cause errors include incomplete hemolysis, sickle cell anemia, high lipid values, elevated bilirubin levels, and a dirty cuvette.[4]

Regulation versus a QC plan

The purpose of quality control is to design a system that assures the validity of the test results at a level acceptable for clinical decision-making. Dr. James O. Westgard and others advocate the use of a QC planning process to select

appropriate QC procedures on the basis of the quality required for the test. That was the theme of a lecture presented in 1994 by Dr. Westgard.[6] This stipulates that each laboratory must define the test quality required for patient care. The National Committee for Clinical Laboratory Standards (NCCLS) has defined a system in the recently published document, "Statistical Quality Control for Quantitative Measurements: Principles and Definitions":[7]

- Define the quality requirement
- Determine method performance — imprecision and bias
- Identify candidate sample quality control strategies
- Predict QC performance
- Set goals for QC performance
- Select appropriate QC.

In an article on electronic QC and the testing process, Dr. Westgard points out that traditional QC monitors many analytical steps and variables in the total testing process. It has proven to be a very efficient technique compared to all the separate checks that are needed to monitor comprehensively all the individual variables.[8]

Laboratories must meet regulatory and accreditation requirements, but the intent and purpose of quality control is to provide valid, clinically meaningful data in order to care for patients.

additional reading

Additional guidance and resource material, plus clinical laboratory and medical-testing procedures and protocols, are available from the following:

American Association for Respiratory Care
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Fax: (972) 484-2720
E-mail: info@aarc.org
http://www.rcjournal.com/online_resources/

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