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SABG INTERPRETATION –
WHICH METHOD SHOULD WE USE IN THE CLINICAL SETTING?

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A research article published in 2002 looked at physician expectations of respiratory care practitioners in patient assessment skills. The assessment skill that was ranked first by physicians was assessment of breath sounds. The skill that was ranked as second in importance was assessment of arterial blood gas and acid-base status.

I was curious if physicians and respiratory care practitioners were using the same assessment paradigm for arterial blood gases. My first step was to conduct a quick informal (nonscientific) survey of the literature (2000 to present) and several textbooks (2003-2005 editions). I looked at several review articles aimed at respiratory therapists, several review articles aimed at registered nurses, and several aimed at the physician. I also examined three standard textbooks used in respiratory care education and one aimed at residents and physicians. I found that those articles and books aimed at respiratory therapists used a different method than those aimed at physicians. Those articles intended for RNs were almost exactly like the respiratory therapist articles. An internet search identified several web sites that discussed interpretation of arterial blood gases. Again these were divided into two common methods. For lack of better terminology, I will refer to these as the "Basic" and "Advanced" methods. The basic method was included in all 3 textbooks aimed at respiratory therapists and the advanced method was found in the one book aimed at a physician audience. The review articles in nursing journals were split with 95% discussing the basic and 5% the advanced method.

Before you start to write me a nasty letter, I am aware that many respiratory care practitioners are aware of and utilize the advanced method of acid-base assessment. My main point is that physicians are taught the advanced method and I am hoping that the advanced method will become more widely used by therapists and nurses alike.

BASIC METHOD

The basic method involves classifying the arterial pH as Normal, Acidemia or Alkalemia and then assessing the $PaCO_2$ and HCO_3^- to see which one is causing the

pH to be abnormal. Then an assessment of the level of compensation is determined to conclude with descriptive adjectives of "Noncompensated", "Partly Compensated" or "Fully Compensated". The problem with this method is that it is a little too simplistic and may not give adequate insight into treatment of these disorders. I will illustrate this with a few examples later in this article.

ADVANCED METHOD

The advanced method starts the same way in assessment of the pH. Respiratory disorders are divided into either "Acute" or "Chronic" while metabolic disorders do not require these terms. The generally held idea is that the respiratory system usually compensates for metabolic disorders in a matter of minutes (10-30 minutes) and that by the time a problem is recognized, the physician orders the ABG, and the blood is collected, the respiratory system should have compensated for the metabolic problem.

If the PaCO2 has not moved to the appropriate position by this time, then the patient also has a respiratory acid-base problem. The advanced method also requires that several calculations be performed to complete the assessment.

Most will agree that to make the best assessment of a patient's acid-base status, knowing the history is extremely important. However, even without knowing the patient's history, the advanced method can give more insight into the acid-base status.

ACID-BASE ASSESSMENT EXAMPLES:

I will start of with some simple straight forward examples and then move on to a few more difficult ones.

Example #1:
pH = 7.49, PaCO2 = 44, HCO3- = 33, Na+ = 142, Cl- = 98

Basic Assessment:
Alkalemia => PaCO2 in normal range => HCO3- increased =>Uncompensated Metabolic Alkalosis

Advanced Assessment:
Alkalemia => possible Metabolic Alkalosis => Anion Gap 11 (normal) => Expected PaCO2 44. Therefore, no other Acid-base disorders, expect Metabolic Alkalosis.

Example #2:
pH = 7.56, PaCO2 = 20, HCO3- = 18, Na+ = 140, Cl- = 103

Basic Assessment:
Alkalemia => PaCO2 is low and HCO3- has decreased as compensation => Partly Compensated Respiratory Alkalosis

Advanced Assessment:

Alkalemia => possible Respiratory Alkalosis => Expected HCO3-: if Acute 20, if chronic 14 => look for another acid-base disorder also present => Anion Gap 19 => an increased anion gap indicates a coexisting metabolic acidosis => Final analysis: Acute Respiratory Alkalosis with an increased gap metabolic acidosis.

We will now try a couple of more complicated examples.

Example #3:
pH = 7.35, PaCO2 = 15, HCO3- = 8, Na+ = 140, Cl- = 104

Basic Assessment:
The pH is in the normal range, but on the acid side => HCO3- is low and PaCO2 has decreased to return pH to normal => Fully Compensated Metabolic Acidosis

Advanced Assessment:
The pH is normal, but we suspect a Metabolic Acidosis => Anion Gap 28 => Bicarbonate Gap 0 => Expected PaCO2 20 => actual PaCO2 is lower than expected => Increased Gap Metabolic Acidosis, plus a Respiratory Alkalosis.

Example #4:
pH = 7.59, PaCO2 = 25, HCO3- = 24, Na+ = 148, Cl- = 95

Basic Assessment:
Alkalemia => PaCO2 is low, but HCO3- is in normal range => Uncompensated Respiratory Alkalosis

Advanced Assessment:
Alkalemia => possible Respiratory Alkalosis => Expected HCO3- 21 => Bicarbonate Gap 17 => Expected HCO3- and Bicarbonate gap tell us that this patient had a pre-existing Metabolic Alkalosis => Anion Gap 29 => patient also has an Increased Gap Metabolic Acidosis.

Final Analysis: Primary Acute Respiratory Alkalosis with an Increased Gap Metabolic Acidosis and a preexisting Metabolic Alkalosis.
We can now calculate the Corrected HCO3- for this patient and we find a value of 41. A value greater than 24 confirms the preexisting Metabolic Alkalosis.

The two different methods outlined here are two different ways of assessing acid-base status. I am not trying to imply that one is correct and one is not correct. These are just two different commonly used assessment methods. The one you use is dependent on personal preference.

However, if you look at the different results from these methods, it appears, at least in my opinion, that the Advanced Method gives a better picture of the patient's acid-base status and treatment options. Also, based on my informal review of the literature mentioned above, if physicians are using the Advanced Method, the other healthcare

providers should at least understand this method to better communicate with the physician.