How to Use the Practice Tool

The purpose of *ABG* *Rush* is to learn arterial blood gas (ABG) values and what they might tell us about a patient. To earn points in the game, it is helpful to know normal ABG values and whether or not abnormal values are acidic or alkaline. Normal values are:

Plasma pH = 7.35-7.45

CO2 = 35mEq/L - 45mEq/L

HCO3 = 22mEq/L - 26mEq/L

The Practice Tool offers two gadgets for learning the meaning of ABG results.

The first gadget is the ABG abacus. It allows the player to quickly identify whether a value is normal, acidic or alkaline. Take a moment to slide the number value for each of pH, CO2 and HCO3. The abacus tells you what values indicate a normal, acidic or alkaline state. Try moving the abacus to the following ABG values:

**pH 7.2, PaCO2 42, HCO3 18**

**What did you find?**

The pH is LOW (<7.35) and therefore ACID.   
The PaCO2 is NORMAL (35mEq/L - 45mEq/L).  
The HCO3 is LOW (<22mEq/L) and therefore ACID.

Can you insert the abacus here? Can you make it work?

The second gadget is the ABG Tic-Tac-Toe board.

It looks like this:

Can you insert our board? Does it really matter?

I also think the word **Neutral** should be changed to **Normal** for consistency. I will need to ask Jennifer to make the change in Spanish.

|  |  |  |
| --- | --- | --- |
| TIC-TAC-TOE | | |
| ACIDIC | NORMAL | ALKALINE |
|  |  |  |
|  |  |  |

To use the tic-tac-toe board the player places each ABG value (pH, CO2 and HCO3) in a corresponding box on the board. Using the ABG results from above, the values would be placed on the tic-tac-toe board like this:

pH = 7.2; LOW (<7.35) and therefore ACID   
CO2  =**42;** NORMAL (35mEq/L - 45mEq/L)  
The HCO3 = 18; LOW (<22mEq/L) and therefore ACID

|  |  |  |
| --- | --- | --- |
| TIC-TAC-TOE | | |
| ACIDIC | NORMAL | ALKALINE |
| pH = 7.2 | CO2 = 42 |  |
| HCO3 = 18 |  |  |

What does this tell the player?

pH tells us if the patient is in acidosis or alkalosis. With a low pH of 7.2 we know the patient is acidic.

The cause of an acidic or alkaline pH is determined by the CO2 or the HCO3 value. An abnormal CO2 value informs us that there is a respiratory problem. An abnormal HCO3 value informs us that there is a metabolic problem. In this example, there is an acidic pH and an acidic HCO3 value indicating a metabolic acidosis.

Now what about compensation? Is the body attempting to correct or compensate for the acidosis? In this case, the CO2 (35 - 45mEq/L) is normal indicating that CO2 is not doing very much to help HCO3 return the body to a normal balance. When the pH is abnormal and either the CO2 orHCO3 is abnormal, then the situation is uncompensated. HCO3 is tanking and CO2 is doing nothing to bail out its partner. Therefore, the **diagnosis is uncompensated metabolic acidosis.**

Results that would indicate **partial compensation** for **metabolic acidosis** are:

|  |  |  |
| --- | --- | --- |
| TIC-TAC-TOE | | |
| ACIDIC | NORMAL | ALKALINE |
| pH = 7.33 |  | CO2 = 33 |
| HCO3 =18 |  |  |

With these values, a state of metabolic acidosis remains because the pH and the HCO3 are still low and CO2 is at a lower value as the body attempts to neutralize the acidotic state. We can see this because the pH is moving closer to normal and the CO2 is closer to an alkaline range (see the Reference notes for more detail). The body is partially compensating for an acidic state.

Results that would indicate that **metabolic acidosis is fully compensated** are:

|  |  |  |
| --- | --- | --- |
| TIC-TAC-TOE | | |
| ACIDIC | NORMAL | ALKALINE |
|  | pH = 7.36 | CO2 = 50 |
| HCO3 = 20 |  |  |

These values indicate full compensation because the pH is normal. However, it is on the low side of normal, leaning towards an acid state (pH = 7.35 – 7.45). HCO3 is low (22- 26 mEq/L) as well, indicating an acidic state with a metabolic cause. CO2 is working like crazy to keep the pH in a normal range, even if it is on the acidic side, and maintain homeostasis. These results indicate a fully compensated metabolic acidosis.

In summary, to determine either acidosis or alkalosis use the tip below.

Compensated states: pH is NORMAL, CO2 (respiratory) and HCO3 (metabolic) are both ABNORMAL  
Partially Compensated states: pH is ABNORMAL, CO2 (respiratory) ***and*** HCO3 are both ABNORMAL   
Uncompensated states: pH is ABNORMAL, CO2 (respiratory) ***or*** HCO3 (metabolic) is ABNORMAL

Use both gadgets, the abacus tool and the tic-tac-toe board, to practice diagnosing ABG results. When you are ready to play ABG Rush, think about the patient history and signs & symptoms in combination with the blood results to determine the diagnosis and develop a deeper appreciation for the patient care needs.