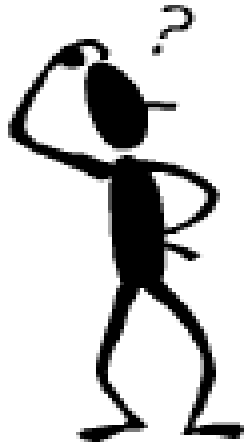


Acid-Base Balance Made Easy



Purpose of ABG

- **Assess degree to which lungs are able to provide adequate oxygen & remove CO₂ & degree to which the kidneys are able to reabsorb or excrete HCO₃**



You Must Know What is Normal to be Able to Know What is Abnormal

- **pH = 7.35 to 7.45**
- **PaCO₂ = 35 to 45 mm Hg**
- **PaO₂ = 80 to 100 mm Hg**
- **HCO₃ = 22 – 26 mEq/l**

What You Must Look at to Interpret ABGs



Look at Your pH

- **Is it normal?**
- **Is it high ?**
- **Is it low?**



Examples

- **pH = 7.36**
- **pH = 7.23**
- **pH = 7.47**
- **A high pH indicates alkalosis**
- **A low pH indicates acidosis**

Look at Your PaCO₂

- **Is it normal ?**
- **Is it high ?**
- **Is it low ?**
- **This is the respiratory component**
- **An abnormality in the PaCO₂ will indicate a respiratory problem**



Examples

- **PaCO₂ = 40 mm Hg**
- **PaCO₂ = 23 mm Hg**
- **PaCO₂ = 48 mm Hg**
- **A high PaCO₂ indicates acidity**
- **A low PaCO₂ indicates alkalosis**

PaCO₂

- **Lungs will increase or decrease ventilation to remove the appropriate amount of CO₂**
- **Lung compensation begins quickly**

Now Look at Your HCO_3

- Is it normal ?
- Is it high ?
- Is it low ?
- This is the metabolic component
- An abnormality in the HCO_3 indicates a metabolic problem



Examples

- $\text{HCO}_3 = 25 \text{ mEq/l}$
- $\text{HCO}_3 = 19 \text{ mEq/l}$
- $\text{HCO}_3 = 32 \text{ mEq/l}$
- **A low HCO_3 indicates acidity**
- **A high HCO_3 indicates alkalosis**

HCO₃

- **The kidneys excrete Hydrogen (acid) & retain bicarbonate (base) to help maintain pH**
- **Renal compensation is slow**

Let's Look at the 4 Situations that Can Occur



Acidosis

- **Develops when:**
- **Excess accumulation of acid**
- **Decreased amount of alkali**
- **Can be respiratory or metabolic**

Metabolic Acidosis

ABG:

Low pH (below 7.35)

Decreased HCO₃ (below 22)

PaCO₂ will be normal

Remember both the pH & HCO₃ will be low

Metabolic Acidosis

- **Caused by too much acid in the body or loss of bicarbonate**
- **Diarrhea (loss of HCO_3)**
- **Diabetic ketoacidosis**
- **Renal failure**

Respiratory Acidosis

- **ABG:**
- **Low pH (below 7.35)**
- **Increased PaCO₂ (above 45)**
- **HCO₃ will be normal**

- **Remember the pH will be low & PaCO₂ will be elevated (opposite)**

Respiratory Acidosis

- **Caused by acid buildup due to lungs not eliminating CO₂**
- **Anything that decreased respirations can cause respiratory acidosis**
- **Chronic respiratory disease**
- **CNS depression**

Alkalosis

- **Develops when:**
- **Excess accumulation of bicarbonate**
- **Loss of acid**

Metabolic Alkalosis

- **ABG:**
- **Increase in pH (greater than 7.45)**
- **Increased HCO₃ (greater than 26)**
- **PaCO₂ will be normal**

- **Remember both the pH & the HCO₃ will be elevated**

Metabolic Alkalosis

- **Loss of acid or increase in HCO_3**
- **Vomiting or NG drainage (loss of Hydrogen)**
- **Excessive use of antacids**

Respiratory Alkalosis

- **ABG:**
- **Increase in pH (greater than 7.45)**
- **Decrease in PaCO₂ (less than 35)**
- **HCO₃ will be normal**

- **Remember the pH will be high & PaCO₂ will be low (opposite)**

Respiratory Alkalosis

- **Caused by too much CO₂ being excreted by the lungs**
- **Hyperventilation**

Interpreting ABGs

1st Step Look at pH

- **Is it normal (7.35 to 7.45)**
- **Does it reflect acidosis (less than 7.35)**
- **Does it reflect alkalosis (greater than 7.45)**
- **Label accordingly**

Next Look at PaCO₂

- **This is the respiratory component**
- **Is it normal**
- **Does it reflect alkalosis (less than 35)**
- **Does it reflect acidosis (greater than 45)**
- **Label accordingly**

Next Look at the HCO_3

- This is the metabolic component
- Is it normal
- Does it reflect acidosis (less than 22)
- Does it reflect alkalosis (greater than 26)
- Label accordingly

Let's Put It All Together



Problems

- **pH of 7.33**
- **PaCO₂ of 40 mmHg**
- **HCO₃ of 20 mEq/L**

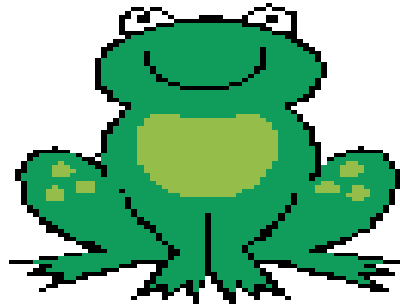
- **What does this indicate**
- **Break it down**



- **pH = acidosis**
 - **PaCO₂ = normal**
 - **HCO₃ = acidosis**
-
- **An abnormal HCO₃ indicates a metabolic problem**

Metabolic Acidosis

Way to
go!!



Problem

- **pH of 7.59**
- **PaCO₂ of 29 mm Hg**
- **HCO₃ of 24mEq/L**

- **What does this indicate**
- **Break it down**

- **pH = alkalosis**
- **PaCO₂ = alkalosis**
- **HCO₃ = normal**



- **An abnormal PaCO₂ indicates a respiratory problem**

Respiratory Alkalosis



Problem

- **pH of 7.25**
- **PaCO₂ of 61 mmHg**
- **HCO₃ of 26 mEq/L**

- **What does this indicate**
- **Break it down**

- **pH = acidosis**
- **PaCO₂ = acidosis**
- **HCO₃ = normal**



- **An abnormal PaCO₂ indicates a respiratory problem**

Respiratory Acidosis

You are
doing a
great job !!



Problem

- **pH of 7.51**
- **PaCO₂ of 44mmHg**
- **HCO₃ of 56**

- **What does this indicate**
- **Break it down**



- **pH = alkalosis**
 - **PaCO₂ = normal**
 - **HCO₃ = alkalosis**
-
- **An abnormal HCO₃ indicates a metabolic problem**

Metabolic Alkalosis



You have
become an
ABG pro!!

You Are Doing Great



Compensation

- **Occurs as the body begins to correct the acid base imbalance**
- **pH will be normal or near normal if total compensation**
- **pH will be abnormal if partial compensation**

Compensation

- **Both the PaCO₂ & HCO₃ will be abnormal**
- **Respiratory imbalances are compensated for by the renal system**
- **Metabolic imbalances are compensated for by the respiratory system**

Example

- **pH of 7.27**
- **PaCO₂ of 27 mm Hg**
- **HCO₃ of 10 mEq/l**

- **Note that both the PaCO₂ & the HCO₃ are low**

Let's Break it Down

- **Low pH = acidosis**
- **Low PaCO₂ = alkalosis**
- **Low HCO₃ = acidosis**
- **HCO₃ corresponds with the pH**
- **This is a metabolic problem**
- **Metabolic acidosis with partial compensation**

Problems

- **pH of 7.52**
- **PaCO₂ of 47 mmHg**
- **HCO₃ of 36 mEq/L**

- **What does this indicate**
- **Break it down**





- **pH = alkalosis**
- **PaCO₂ = acidosis**
- **HCO₃ = alkalosis**

- **Which 2 go together**

Metabolic Alkalosis with Partial Compensation

You are
doing great!!



Problems

- **pH of 7.45**
- **PaCO₂ of 50 mmHg**
- **HCO₃ of 33 meq/L**

- **What does this indicate**
- **Break it down**



- **pH = normal**
- **PaCO₂ = acidosis**
- **HCO₃ = alkalosis**



- Your pH leans toward the alkalosis side

Fully Compensated Metabolic Alkalosis

You have
done great!!

