

Introduction To Acid / Base




Pure derangements in acid / base balance can be produced in the laboratory by directly altering the blood's ionic and carbon dioxide content.

Clinically, derangements in acid / base balance are usually complications resulting from one or more underlying disease processes. A primary treatment goal is to diagnose and treat the underlying disease.

But in addition, acid / base disturbances can proceed to a severe acidosis or alkalosis that is damaging in its own right and potentially fatal. Thus, accurate evaluation of acid / base status is an important clinical objective.

This exercise tests your diagnostic skills by presenting 5 patients who may or may not have derangements in acid / base balance.



In each case, load the patient, go to , take the necessary blood samples, and answer the questions regarding the patient's acid / base status based on the blood chemistry.

If you are not familiar with the process of loading patients, refer to the chapter **Patients** in QCP's **User's Guide**.

Evaluating Acid / Base Status

This is a brief review of what to look for in evaluating acid / base balance. Refer to your textbook for additional information.



Blood pH Examine the pH to see if it is greater than or less than normal. Remember that in certain circumstances, serious derangements in acid / base balances are accompanied by rather small changes in blood pH.

Blood H⁺ concentration, in nMol/L, is an alternative to pH. [H⁺] and pH supply exactly the same information.

$\text{pH} = -\log ([\text{H}^+])$ with H⁺ in Mol/L


Blood pCO₂. Examine blood pCO₂ to see if it is greater than or less than normal. The partial pressure of CO₂ in the blood has a significant affect on blood pH and also respiration rate. Changes may be either primary (and causal) or secondary (and compensatory).

Anion Gap. Look for an abnormal blood anion gap. The anion gap is defined as the blood's sodium concentration minus the chloride concentration minus the bicarbonate concentration.

$\text{Anion Gap} = [\text{Na}^+] - [\text{Cl}^-] - [\text{HCO}_3^-]$

With sodium being the blood's chief cation and chloride and bicarbonate being the blood's chief anions, the anion gap represents additional unmeasured anions in the blood. If the gap increases, it signals the presence in the blood of additional, unseen anions. Lactate and ketoacids are prime suspects.

Normal Values

Before loading and analyzing the patients, go to , take the necessary blood samples, and record normal values for venous blood.



pH	
[H+] (nMol/L)	
pCO2 (mmHg)	
[HCO3-] (mEq/L)	
Anion Gap (mEq/L)	

Patient Acid_1

pH	
[H+] (nMol/L)	
pCO2 (mmHg)	
[HCO3-] (mEq/L)	
Anion Gap (mEq/L)	

Primary Disturbance

Compensation



Normal

- None

Respiratory Acidosis

- Respiratory

- Respiratory Alkalosis
- Metabolic
- Metabolic Acidosis
- Metabolic Alkalosis

The most likely explanation is

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Patient Acid_2

pH	
[H+] (nMol/L)	

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pCO ₂ (mmHg)	
[HCO ₃ ⁻] (mEq/L)	
Anion Gap (mEq/L)	

Primary Disturbance Compensation

Normal

- None

Respiratory Acidosis

- Respiratory

- Respiratory Alkalosis
- Metabolic
- Metabolic Acidosis
- Metabolic Alkalosis



The most likely explanation is

Patient Acid_3

pH	
[H+] (nMol/L)	
pCO ₂ (mmHg)	
[HCO ₃ ⁻] (mEq/L)	
Anion Gap (mEq/L)	

Primary Disturbance

Compensation



Normal

- None

Respiratory Acidosis

- Respiratory

- Respiratory Alkalosis
- Metabolic
- Metabolic Acidosis
- Metabolic Alkalosis

The most likely explanation is

Patient Acid_4

pH	
[H+] (nMol/L)	



pCO ₂ (mmHg)	
[HCO ₃ ⁻] (mEq/L)	
Anion Gap (mEq/L)	

Primary Disturbance Compensation

Normal

- None

Respiratory Acidosis

- Respiratory

- Respiratory Alkalosis
- Metabolic
- Metabolic Acidosis
- Metabolic Alkalosis



The most likely explanation is

Patient Acid_5

pH	
[H+] (nMol/L)	
pCO2 (mmHg)	
[HCO3-] (mEq/L)	
Anion Gap (mEq/L)	

Primary Disturbance

Compensation



Normal

- None

Respiratory Acidosis

- Respiratory

- Respiratory Alkalosis

- Metabolic

- Metabolic Acidosis

- Metabolic Alkalosis

The most likely explanation is

