Acid-Base Balance

Determining the acid-base status of a patient is a three step process.

1. pH

Decide whether the patient is normal, acidotic, or alkalotic by looking at the pH. Normal is 7.4 (range 7.3-7.5, although sources vary somewhat on this). Lower indicates an acidosis, higher an alkalosis.

2. Primary cause

To be a primary respiratory problem, CO_2 must be high in acidosis, or low in alkalosis. Normal is 40mmHg. To be a primary metabolic problem, bicarbonate (HCO_3) must be low in acidosis, or high in alkalosis. Normal is 24mmol. Unlike in MVST1a physiology, recall that a mixed problem is possible (primary respiratory and metabolic).

3. Compensation

Has the other component shifted to reduce the pH change caused by the primary problem? Compensation involves the following:

Primary problem	**Compensation**	**Primary problem**	**Compensation**
Resp. acidosis	↑ bicarb	Metab. acidosis	↓ pCO_2
Resp. alkalosis	↓ bicarb	Metab. alkalosis	↑ pCO_2

Compensation for a metabolic problem tends to be rapid (seconds to minutes), so an uncompensated metabolic acidosis or alkalosis is quite rare.

Base Excess

Base excess (BE) is the bicarbonate content of the blood, if the CO_2 was normal. A positive base excess indicates that the kidney is producing HCO_3, thus making the blood more alkaline (causing a metabolic alkalosis, or compensating for a respiratory acidosis). A negative base excess is sometimes called a base deficit.

Summary

Problem	**pCO_2**	**HCO3**	**BE**
Respiratory acidosis	>40	24	0
Compensated respiratory acidosis	>40	>24	>0
Respiratory alkalosis	<40	24	0
Compensated respiratory alkalosis	<40	<24	<0
Metabolic acidosis	40	<24	<0
Compensated metabolic acidosis	<40	<24	<0
Metabolic alkalosis	40	>24	>0
Compensated metabolic alkalosis	>40	>24	>0
Mixed acidosis	>40	<24	<0
Mixed alkalosis	<40	>24	>0

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