

ACID-BASE

SIMPLIFIED STEWART APPROACH

What fluid should I give?

Dr. David Lyness

propofology.com

1. BASE EXCESS (BE) = MEASURE OF METABOLIC ACID-BASE STATUS

BE = amount of strong univalent acid (HCl) or base (NaOH) required to titrate 1 L of blood back to pH 7.40, 1 mmol/L = 1 meq/L.
No metabolic base-excess changes are expected with acute respiratory changes. Normal value = -3 to +3 mmol/L
More negative values = metabolic acidosis and More positive values = metabolic alkalosis.
Corrected = approximately 0.4 mmol/L for every 1mmHg chronic change in carbon dioxide partial pressure (1mmHg = 0.13kPa)

2. KEY METABOLIC FACTOR = PLASMA STRONG-ION DIFFERENCE

SID is the sum of (sodium, potassium, calcium, and magnesium) minus (chloride and lactate).
A reduced SID suggests a lower bicarbonate level and the presence of an acidosis.
If the SID is increased = increased bicarbonate level = alkalosis SODIUM, CHLORIDE & LACTATE are the most important in SID.

3. WEAK ACIDS ARE ALSO IMPORTANT FOR METABOLIC ACID-BASE CHANGES

Albumin (mostly) and Phosphate. Albumin in plasma has an overall negative charge
Weak acids are partly dissociated acids & not strong ions.
The SID does not influence the total weak acid concentration
The total weak acid concentration does not influence the SID.
Total amounts of weak acids can be important
Acidosis is caused by a decrease in the SID + increase in total weak acid concentration
Alkalosis is caused by an increase in the SID + decrease in total weak acid concentration
Critically ill = decreased SID causing acidosis and a decreased weak acid concentration = less metabolic alkalosis.

4. CHANGE IN B.E. = CHANGES IN SID AND THE AMOUNT OF WEAK ACID

5. ALBUMIN IS THE PRINCIPAL WEAK ACID

Electrical charge of albumin = 0.25 × albumin concentration in grams per liter

Albumin base-excess effect, meq/L = 0.25 × (42 - measured albumin).
For every 10 g/L decrease in plasma albumin, the BE will increase by 2.5 meq/L = more alkalotic.

6. THE DIFFERENCE BETWEEN Na+ AND Cl- ION CONC = PREDOMINANT SID



For every 1 meq/L change in the Na-Cl difference, the base excess will change by 1 meq/L: in the negative direction for a decrease in the SID, and in the positive direction for an increase in the SID.

7. LACTATE = THE OTHER CLINICALLY IMPORTANT PLASMA STRONG ION

Lactate base-excess effect (meq/L) = 1 - measured lactate.

8. CONSIDER OTHER CHANGES IN STRONG IONS AND WEAK ACIDS

OTHER IONS (OI) = potassium, calcium, and magnesium
OTHER (UNMEASURED) IONS = proteins, lithium, or aluminum.

?0.9% saline
?Hartmann's
?Albumin

SUMMARY

Base-excess = Na-Cl effect + lactate effect + albumin effect + OI effect.

$$\text{Base-Excess} = [\text{Na} - \text{Cl} - 35] + [1 - \text{lactate}] + [0.25 \times (42 - \text{albumin})] + \text{OI}$$

$$\text{OI} = \text{Base-excess} - [\text{Na} - \text{Cl} - 35] - [1 - \text{lactate}] - [0.25 \times (42 - \text{albumin})]$$

can help guide better fluid choices in the critically ill