BEST PRACTICES

Stepwise Approach to Acid-base Disorders

Acidosis or Alkalosis? → Primary Problem? → Compensation? → Added Acid? → Additional Disorder?

01 pH?

$[H^+] = 10^{(9-pH)}$

If { $[H^+] \approx \frac{24(PaCO^2)}{[HCO^{3-}]}$ }

then pH is valid

- <7.35 Acidemia
- > 7.45 Alkalemia

02 HCO_3 & $PaCO_2$?

- Respiratory Acidosis ↑$PaCO_2$
- Respiratory Alkalosis ↓$PaCO_2$
- Metabolic Acidosis ↓HCO_3
- Metabolic Alkalosis ↑HCO_3

03 Expected $PaCO_2$, pH, & HCO_3

Respiratory Acidosis ↑$PaCO_2$	Δ $PaCO_2$*	Δ pH	Δ HCO_3**
Acute	↑ 10	↓ 0.07	↑ 1
Chronic	↑ 10	↓ 0.03	↑ 3-4

Respiratory Alkalosis ↓$PaCO_2$	Δ $PaCO_2$*	Δ pH	Δ HCO_3**
Acute	↓ 10	↑ 0.08	↓ 2
Chronic	↓ 10	↑ 0.03	↓ 5

HCO_3 < expected HCO_3: combined **metabolic acidosis**
HCO_3 > expected HCO_3: combined **metabolic alkalosis**

$PaCO_2 = (1.5 * [HCO_3^-]) + 8 \pm 2$

$PaCO_2 = 0.7 * ([HCO_3^-] - 24) + 40 \pm 2$

$PaCO_2$ > expected $PaCO_2$: combined **respiratory acidosis**
$PaCO_2$ < expected $PaCO_2$: combined respiratory alkalosis

04 Anion Gap?

$AG = Na^+ - (Cl^- + HCO_3^-)$

Hypoalbuminemia?
Add 2.5 meq/L for each 1 gm/dL drop in albumin

↑ AG

Added acid:
Methanol
Uremia
Diabetic ketoacidosis
Paraldehyde/propylene glycol
Iron/pyroglutamate/Isoniazid/
Inborn errors of metabolism
Lactic acid
Ethanol
Salicylates

↔ AG

HCO_3 Loss:
Renal
GI

HCO_3 Dilution

05 Δ Δ?

Δ AG compared to Δ HCO_3^-

- **Δ AG = Δ HCO_3^-** No other metabolic abnormality coexists
- **Δ AG > Δ HCO_3^-** Metabolic alkalosis coexists
- **Δ AG < Δ HCO_3^-** Non AG Metabolic acidosis coexists

* Change of $PaCO_2$ from 40 mm Hg
**Change of HCO_3 from 24 mEq/L
Use serum total CO_2 for HCO_3 value

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