

ABG Interpretation — Quick Flowchart & Pocket Guide

Stepwise approach, normal values, common causes & management pearls

Normal ABG values

- pH: 7.35 - 7.45
- PaCO₂: 35 - 45 mmHg
- HCO₃⁻: 22 - 26 mmol/L
- PaO₂: 80 - 100 mmHg (room air)
- SaO₂: >94% (target varies with disease)

Step 1 — Assess pH

- pH < 7.35 : Acidosis
- pH > 7.45 : Alkalosis
- pH normal : Look for mixed disorders if PaCO₂ and HCO₃⁻ are discordant

Step 2 — Primary respiratory or metabolic?

- If PaCO₂ abnormal → respiratory component
- If HCO₃⁻ abnormal → metabolic component
- Compare direction: If pH and PaCO₂ change opposite → respiratory
- If pH and HCO₃⁻ change same direction → metabolic

Step 3 — Compensation expected (quick checks)

- Acute respiratory acidosis: ↑PaCO₂ → ↑HCO₃⁻ by 1 mmol per 10 mmHg
- PaCO₂
- Chronic respiratory acidosis: ↑HCO₃⁻ by 3.5 mmol per 10 mmHg PaCO₂
- Acute respiratory alkalosis: ↓PaCO₂ → ↓HCO₃⁻ by 2 mmol per 10 mmHg
- PaCO₂
- Metabolic acidosis: expected PaCO₂ = 1.5 × HCO₃⁻ + 8 ±2 (Winter's formula)
- Metabolic alkalosis: check urine chloride to guide causes

Common causes — quick lists

- Metabolic acidosis: DKA, renal failure, lactic acidosis, toxins
- (methanol, ethylene glycol)
- Metabolic alkalosis: vomiting, diuretics, hyperaldosteronism
- Respiratory acidosis: hypoventilation (opioids, CNS depression), COPD
- Respiratory alkalosis: hyperventilation (anxiety, pain, hypoxia), sepsis

Practical pearls

- Always check oxygenation and lactate in sick patients
- If mixed disorder suspected, calculate anion gap and delta ratios
- Document time and clinical context (ventilated? COPD?)
- Treat underlying cause + support (O₂, ventilation, fluids, insulin in DKA)

Quick ABG Algorithm

1. Check pH → Acidosis / Alkalosis / Normal
2. Check PaCO₂ and HCO₃⁻ → Respiratory vs Metabolic
3. Use Winter's formula for metabolic acidosis
4. Assess compensation (acute vs chronic rules)
5. Calculate Anion Gap if metabolic acidosis: AG = Na - (Cl + HCO₃)
6. If mixed disorder suspected → consider delta/delta ratios
7. Always correlate clinically (ventilation status, septic, toxins)