8 Steps to ABG Interpretation

Step 1) Obtain ABG and lytes:
   - If you don’t perform the test, you’ll never know what is going on with the patient

Step 2) Determine the primary process:
   - Is it an acidosis or an alkalosis?
   - Is the primary problem respiratory or metabolic?

Step 3) What is the compensation? Is there another process influencing the acid-base status?
   - Look at the HCO3 and decide if it has changed by the expected amount
   - If the change in HCO3 doesn’t fit with the numbers on the table, there may be a second process

<table>
<thead>
<tr>
<th>Primary Disorder</th>
<th>Δ pCO2</th>
<th>Δ HCO3-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute Respiratory Acidosis</td>
<td>↑ 10</td>
<td>↑ 1</td>
</tr>
<tr>
<td>Acute Respiratory Alkalosis</td>
<td>↓ 10</td>
<td>↓ 2</td>
</tr>
<tr>
<td>Chronic Respiratory Acidosis</td>
<td>↑ 10</td>
<td>↑ 3</td>
</tr>
<tr>
<td>Chronic Respiratory Alkalosis</td>
<td>↓ 10</td>
<td>↓ 4</td>
</tr>
<tr>
<td>Metabolic Alkalosis</td>
<td>↑ 0.7</td>
<td>↑ 1</td>
</tr>
<tr>
<td>Metabolic Acidosis</td>
<td>↓ 1</td>
<td>↓ 1</td>
</tr>
</tbody>
</table>

Step 4) Determine the Anion Gap:
   - This must be done even if it doesn’t look like a metabolic acidosis
   - Anion Gap = Na+ - [HCO3- + Cl-] \(\rightarrow\) normal < 12
   - DDx of increased Anion Gap (MUDPILES)
     - Methanol, Uremia, DKA (or other ketoacidoses – starvation/etOH), Paraldehyde, INH/iron, Lactic acid, Ethylene Glycol, Salicylates
     - Real life DDx:
       - Lactic acidosis
       - Ketosis (DKA, starvation, alcohol)
       - Renal failure
       - Poisons (alcohols, ASA, cyanide)

Step 5) If an Anion Gap is present, is it the only process?
   - Measure the ΔAG/Δ HCO3- ratio
     - If the ratio = 1, then the AG is the only process
     - If the ratio \(\neq 1\), then there is another process
       - If ratio > 1, HCO3- is too low, there is a concomitant non-AG acidosis
       - If ratio < 1, HCO3- is too high, there is a concomitant alkalosis
Step 6) Determine the Osmolar Gap

- Osmolar gap = measured osmolality – calculated osmolality → normal < 10
- Measured Osm: given to you by the lab
- Calculated Osmolality = 2x[Na+] + glucose + urea
  ○ “2 salts and a sugar bun”
- DDx of increased Osmolar gap = ALCOHOLS
  ○ Methanol, Mannitol, Acetone, EtOH, isopropyl EtOH, Ethylene glycol, others
  ○ Combined AG and Osmolar gap = Methanol or Ethylene glycol

Step 7) Determine the A-a gradient

- A-a gradient
  ○ A-a gradient = PA02 (calculated) – PaO2 (measured)
  ○ Normal A-a gradient is < 10
- How do you calculate the PA02?
  ○ PA02 = (Pbar – PH20) x FiO2 – (PaC02 x 1.25)
- For patients on room air the formula can be simplified to:
  ○ A-a gradient = PAO2 – PaO2
  = 150 – (PaC02 x 1.25) – PaO2
- For patients on Oxygen, you need to use the full formula:
  ○ A-a gradient = PA02 – PaO2
  = (Pbar – PH20) x FiO2 – (PaC02 x 1.25) – PaO2
  = (713 x FiO2) – (PaC02 x 1.25) – PaO2

Step 8) DDx of hypoxemia

- Normal A-a gradient (<10)
  ○ Low inspired O2 content (low FiO2 or low PiO2)
  ○ Hypoventilation
- Increased A-a gradient (>10)
  ○ V/Q mismatch
    - Asthma, COPD, Alveolar filling (fluid, blood, pus), pulmonary vascular disease
  ○ Shunt
    - Physiologic shunt
    - Intra-cardiac (ASD, PFO or VSD)
    - Intra-pulmonary
      - With normal capillaries: atelectasis or consolidation
      - With abnormal capillaries: p AVM’s or intrapulmonary vasodilatation in HPS
  ○ Diffusion abnormality
    - Severe ILD, severe COPD, etc…