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-] → 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 ≠ 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
ABG session for POS
September 2020

**Step 6) Determine the Osmolar Gap**

- Osmolar gap = measured osmolality – calculated osmolality \(\rightarrow\) normal < 10
- Measured Osm: given to you by the lab
- Calculated Osmolality = \(2\times[\text{Na}^+] + \text{glucose} + \text{urea}\)
  - “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 = \(\text{PAO}_2\) (calculated) – \(\text{PaO}_2\) (measured)
  - Normal A-a gradient is < 10
- How do you calculate the \(\text{PAO}_2\)?
  - \(\text{PAO}_2 = (P\text{bar} – \text{PH}_2\text{O}_2) \times \text{FiO}_2 – (\text{PaC}_2 \times 1.25)\)
- For patients on room air the formula can be simplified to:
  - A-a gradient = \(\text{PAO}_2 – \text{PaO}_2\)
  - \(\text{PAO}_2 = 150 – (\text{PaC}_2 \times 1.25) – \text{PaO}_2\)
- For patients on Oxygen, you need to use the full formula:
  - A-a gradient = \(\text{PAO}_2 – \text{PaO}_2\)
  - \(\text{PAO}_2 = (P\text{bar} – \text{PH}_2\text{O}_2) \times \text{FiO}_2 – (\text{PaC}_2 \times 1.25) – \text{PaO}_2\)
  - \(\text{PAO}_2 = (713 \times \text{FiO}_2) – (\text{PaC}_2 \times 1.25) – \text{PaO}_2\)

**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…