A VERY BASIC APPROACH TO BLOOD GAS ANALYSIS

BLOOD GASES TYPICALLY PRESENTED AS
pH / PaCO₂ / PaO₂ / bicarb / base excess or deficit (BE/BD)

Values for these are:

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Acidotic</th>
<th>Alkalotic</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>7.40</td>
<td>&lt;7.40</td>
<td>&gt;7.40</td>
</tr>
<tr>
<td>PaCO₂</td>
<td>40 mm Hg</td>
<td>&gt;40</td>
<td>&lt;40</td>
</tr>
<tr>
<td>PaO₂</td>
<td>100 mm Hg</td>
<td>&lt;24</td>
<td>&gt;24</td>
</tr>
<tr>
<td>HCO₃</td>
<td>24 mEq/L</td>
<td>&lt;24</td>
<td>&gt;24</td>
</tr>
<tr>
<td>BE/BD</td>
<td>0 mEq/L</td>
<td>&lt;0 (BD)</td>
<td>&gt;0 (BE)</td>
</tr>
</tbody>
</table>

A normal gas would be 7.40/40/100/24/0.

A QUICK ASIDE ABOUT BICARB & BE/BD
- Bicarb on blood gases isn’t measured, it’s calculated.
- In practice, not much difference between two values.
- Base excess/deficit = Difference from bicarb of 24
  - Bicarb of 21 ≈ Base deficit of -3
  - Bicarb of 27 ≈ Base excess of +3

WHAT ABOUT ARTERIAL VS VENOUS GASES?
- When determining acid/base balance, difference is negligible.
- Can adjust venous PaCO₂ by 5 (normal venous PaCO₂ = 45) and venous pH by 0.05 (normal venous pH = 7.35).
- However, when assessing oxygenation, need arterial blood gas!

STEPS TO ANALYSIS
1. **Look at pH.** Alkalemic or acidemic?
   - If alkalemic, then alkalosis is primary. If acidemic, acidosis is primary.
2. **Look at components.**
   - PaCO₂ (respiratory component) - alkalemic or acidemic?
   - HCO₃/BE/BD (metabolic component) - alkalemic or acidotic?
3. **Which component agrees with pH?**
   - Whichever agrees with pH (respiratory or metabolic) is “primary”.
   - If the other component is in the other direction, it is “secondary”.
   - If they both agree, then it is “combined”.

ASSESSING OXYGENATION
- **PaO₂/FiO₂ ratio**
  - Quickest method. Used as a criteria for ARDS severity.
  - Normally, should be 500. On room air, normal PaO₂ = 100.
  - So, 100/0.21 = 500.
  - PaO₂/FiO₂ between
    - 200-300 = Mildly diminished oxygenation
    - 100-200 = Moderately diminished oxygenation
    - <100 = Severely diminished oxygenation
- **Oxygenation index (OI)**
  - Accounts for ventilation needs. Used for criteria for ECMO.
  - Higher the OI, the worse it is (>20 is bad, >40 consider ECMO).
  - OI = (Mean airway pressure x FiO₂) x 100/PaO₂.