Arterial Blood Gases

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Blood Gas Sampling

1. The syringe should be held at a 45° angle or less to your opposite hand, much like you would hold a pencil or a dart. This near parallel insertion of the needle will minimize trauma to the artery and allow the smooth muscle fibers to seal the puncture hole when you withdraw the needle.

Transport of Gas
External Respiration

Inhale
Gas Exchange

Regulation of Acid-Base Balance

Normal Blood Gas Parameters

**ARTERIAL BLOOD GAS INTERPRETATION**

- **VALUE NORMAL**
- pH 7.35 - 7.45
- PaCO2 35 - 45 mmHg
- HCO3 22 -26 mEq/L
- PaO2 80 -100 mmHg
- Oxygen saturation >90%
HYPOXEMIA

****When assessing for hypoxemia always know the FiO2****
60 - 80 mmHg  Mild Hypoxemia
40 - 60 mmHg  Moderate Hypoxemia
Below 40 mmHg  Severe Hypoxemia
Base Excess

- Base excess or base deficit is a measurement reflecting the non-respiratory portion of acid-base balance. Base excess is reported as a positive or negative value depending on which direction the buffer base has deviated from normal.
- Normal value ± 2 mEq/L

Assessment Step 1

- Identify pH
  - Is it normal, high or low?
  - If low, acidosis
  - If high, alkalosis
- Metabolic Component
  - Identify the HCO3
  - Is it normal, high or low?
  - If high, alkalosis
  - If low, acidosis
- Respiratory Component
  - Identify the PaCO2
  - Is it normal, high or low?
  - If high, acidosis
  - If low, alkalosis
- Identify the PaO2
  - Determine if normal or if abnormal, the degree of abnormality

Assessment Step 2

- Once the acid-base disorder is identified as respiratory or metabolic, look for the degree of compensation occurring.
- Degrees of compensation are classified as:
  - Uncompensated
  - Partially Compensated
  - Fully Compensated
Respiratory Acidosis

RESPIRATORY

PaCO2  >  45 mmHg.

TREATMENT:
Increase Ventilation

Respiratory Alkalosis

• RESPIRATORY

PaCO2  <  35 mmHg

TREATMENT:
Treat the Cause

Metabolic Acidosis

• METABOLIC

HCO3  <  22 mEq/L

TREATMENT:
Administer Bicarbonate
Metabolic Alkalosis

• METABOLIC

\[ \text{HCO}_3^- \ > \ 26 \text{ mEq/L} \]

TREATMENT:
Treat the Cause

Acid-Base Abnormalities

– RESPIRATORY ACIDOSIS:
VENTILATION FAILURE.

• Involves the retaining of CO2 and increase in alveolar ventilation (Hypoventilation).

• You will see an increase in CO2 and decrease in pH.

Acid-Base Abnormalities

– RESPIRATORY ALKALOSIS:
– ALVEOLAR HYPERVENTILATION

• Involves the blowing off of CO2 and increase in alveolar ventilation (Hyperventilation).

• You will see a decrease in CO2 and increase in pH.
Acid-Base Abnormalities

• METABOLIC ACIDOSIS:
  – Caused by having excess acid reacting with HCO3, thus decreasing HCO3.

• You will see a decreased HCO3, pH and BE.

Acid-Base Abnormalities

• METABOLIC ALKALOSIS:
  – Occurs when there is a loss of acids.

• You will see an Increased HCO3, pH and BE.

COMPENSATION AND CORRECTION OF ACID/BASE IMBALANCES

• CORRECTION:
  – When an abnormal pH is returned towards normal by altering the component that is responsible for the imbalance.

• COMPENSATION:
  – When an abnormal pH is returned towards normal by altering the component that is not responsible for the imbalance.

• ***Note: The lungs can compensate quickly, where kidneys may take hours to days.***
• RESPIRATORY ALKALOSIS:
  • Decreased CO2, increased pH due to hyperventilation and hypoxemia.
  • Compensation is via the kidneys by excreting more HCO3, thus HCO3 is decreased and pH returns toward normal.

• METABOLIC ACIDOSIS: Decreased HCO3, pH and BE.
  • Compensation is via the lungs by increasing ventilation, thus causing a decrease in CO2 and pH returns towards normal.

• METABOLIC ALKALOSIS:
  • Increased HCO3, pH and BE.
  • Compensation is via the lungs by decreasing ventilation, thus causing an increased CO2 and pH returns towards normal.
  • ***Note: This can become dangerous due to the fact that one can hypoventilate for only so long before the PO2 will decrease and peripheral chemoreceptors will start and increase ventilation.
COMPENSATION AND CORRECTION FOR

• RESPIRATORY ACIDOSIS: Increased CO2, decreased pH due to hypoventilation.

• Compensation is via the kidneys by excreting more acid and less HCO3, thus increasing HCO3 and pH returns towards normal.

ABG

• pH 7.19
• PaCO2 88mmHg
• PaO2 48mmHg
• HCO3 20mEq/L
• BE -2

<table>
<thead>
<tr>
<th>ABG Parameters</th>
<th>Normal Values</th>
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<tbody>
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<tr>
<td>BE</td>
<td>-3 to +2 mEq/L</td>
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ABG

• pH 7.48
• PaCO2 49mmHg
• PaO2 72mmHg
• HCO3 33mEq/L
• BE + 8