1 Understanding ABG’s……
Plan of care for clients experiencing respiratory acidosis and alkalosis

2 First the Basics……..
- An ACID is a substance which can donate a hydrogen ion or freely dissociate a hydrogen ion. All ACIDS have a positive (+) charge
  EX: Hydrochloric Acid (HCl)
- A BASE is a substance which can accept a hydrogen ion. All BASES have negative (-) charge.
  EX: Bicarbonate (HCO3)

3 pH Chart

4 How do we evaluate acid-base balance—what values do we need to know????

Normal Values
- pH: 7.35 - 7.45
- PaCO2: 35 - 45
- PaO2: 60-80
- HCO3: 22-26

5 Respiratory Acidosis vs. Alkalosis
- Respiratory Acidosis
  - An increase in hydrogen ion concentration as a result of impaired elimination of CO2
- Respiratory Alkalosis
  - A decrease in hydrogen ion concentration as a result of excess elimination of CO2

6 High Risk Populations
- Respiratory Acidosis
  - hypoventilation
  - acute pulmonary edema
  - airway obstruction
  - pneumothorax
  - sedation overdose
  - severe pneumonia
  - COPD, Asthma
  - CNS lesion
  - respiratory system disorders
- Respiratory Alkalosis
  - hyperventilation
  - respiratory and CNS disorders
  - severe infections and fever
  - vigorous mechanical ventilation
  - inadequate oxygen in inspired air
  - overrapid correct of metabolic acidosis
Compensatory mechanisms to restore acid-base balance

1. Resp acidosis
   - Increase RR/depth to eliminate CO2
   - Sequestration (hiding) H+ ions & CO2 in chemical & protein buffers
   - Kidneys conserve bicarbonate ions
2. Resp alkalosis
   - Decrease RR/depth to retain CO2
   - Release H+ ions from chemical & protein buffers
   - Kidneys eliminate bicarbonate buffers

Metabolic Comparisons

1. Metabolic acidosis
   - Decreased pH<7.35
   - Decreased HCO3<22
   - Increased H+ ions
   - Compensation by decrease in CO2<35
   - May be seen with K+>5.0
2. Causes
   - Starvation
   - DKA
   - Renal failure
   - Shock
   - diarrhea

Metabolic Alkalosis

1. Metabolic Alkalosis
   - Increased pH>7.45
   - Increased HCO3>26
   - Decreased H+ ions
   - May be seen with K+<3.5
   - Compensation is a result of increase in CO2>45
2. Causes
   - Gastric suctioning
   - Loss of gastric acid juices
     - vomiting

Respiratory Acidosis Overview

- an increase in hydrogen ion concentration as a result of impaired elimination of CO2
Respiratory acidosis
- increased respiratory rate/depth to eliminate CO2
- sequestration (hiding) of H+ ions and CO2 in chemical and protein buffers
- Kidneys conserve bicarbonate ions

11 Restoration of Acid Base Imbalance
- Partial Compensation
  - a state in which compensatory regulatory mechanisms work to correct the acid base imbalance but have not achieved a pH value within normal limits.
    - *Bicarbonate is becoming more alkalotic or “Base”*
    - *pH remains abnormal*

12 Respiratory Acidosis with Partial Compensation (Can be good or bad)
- *post-op client who hypoventilated after surgery gets some assist ventilation*
  - initial ABG: uncompensated resp acidosis
  - corrective action causes partial compensation
- *COPD patient with chronic disease develops an alteration to ventilation/perfusion and the PCO2 rises enough to cause a lack of balance*
  - initial ABG: fully compensated resp acidosis
  - *a physiologic insult causes the client to switch into a partial compensation*

13 Restoration of Acid Base Imbalance
- Full Compensation
  - a state in which compensatory regulatory mechanisms have restored a normal concentration of hydrogen ions with a resultant normal pH value.

14 Restoration of Acid Base Imbalance
- Full compensation can exist with a client that has chronic use of compensatory mechanisms
- full compensation requires the pH to be a normal “low” value of 7.35-7.4 with an altered PCO2 and HCO3
  - the client with lung disease that is persistently hypercapneic
    - HCO3 remains chronically elevated to offset the persistently elevated PCO2

15 Potential for: respiratory acidosis
- Identify clients at risk for experiencing acidosis
- Assess for the presence of acidosis or worsening acidosis in a client with chronic disease:
  - hypoventilation, tachy-brady dysrhythmias, HA, lethargy, AMS, coma, N/V
- mon labs; ABGs and electrolytes
  - decreased pH, Increased PCO2/HCO3, hyperkalemia, decreased serum Cl
- mon pulse oximetry continuously during acute phase

16 Potential for: respiratory acidosis
- elevate HOB
- encourage breathing exercises
- Perform assist ventilation or airway suctioning as indicated
- administer oxygen therapy and monitor effectiveness
- prepare to initiate mechanical ventilation for refractory hypoxemia, worsening mental status, breathing pattern, etc.

*Refractory: client’s status following interventions*

17 Steps in ABG analysis
- Review normal ABG values
- assess for presence of acidosis in pH, PCO2
- assess for presence of compensation in HCO3
- determine state of compensation, if any

18 Let’s review ABG components
**NORMAL VALUES**
- pH: 7.35-7.45
- PaCO2: 35-45
- HCO3: 22-26

19 **Is the pH abnormal?**
Determine if it is acidotic < 7.35 or alkalotic > 7.45 and record

**Is the pH is normal?**
If so, record. You may still have an acid-base imbalance though. Such a state is referred to as an acid-base imbalance that is in compensation.

20 **Evaluate the PaCO2**
Determine if it is acidotic > 45 mm Hg or alkalotic < 35 mm Hg.

21 **Evaluate the HCO3**
Determine if it is acidic < 22 or alkalotic > 26.

22 **Respiratory Alkalosis Overview**
- a decrease in hydrogen ion concentration as a result of excess elimination of CO2
Compensatory Regulatory Mechanisms to Restore of Acid-Base Balance

Respiratory alkalosis
– decreased respiratory rate/depth to retain CO2
– release of H+ ions from chemical and protein buffers
– Kidneys eliminate bicarbonate ions

23 Potential for: respiratory alkalosis
- Assess for clients at risk for alkalosis
- assess for s/s of alkalosis: numbness, tingling, carpopedal spasm, muscle weakness,
- mon ABGs and electrolytes for decreased PCO2, increased pH, decreased HCO3
- examine client for possible cause of alkalosis

24 Potential for: Respiratory Alkalosis
- Hyperventilation syndrome:
  – instruct client in breathing exercises to increase PCO2 using rebreathing devices when needed
  – initiate plan of care for anxiety
  – consult MD re: sedation

25 Compensation of Respiratory Alkalosis
- What pH, PCO2, HCO3 values would indicate partial compensation, and why?
  – pH_____ PCO2_____ HCO3_____ 

- What pH, PCO2, HCO3 values would indicate full compensation, and why?
  – pH_____ PCO2_____ HCO3_____ 

26 Steps in ABG analysis
- Review normal ABG values
- assess for presence of alkalosis in pH, PCO2
- assess for presence of compensation in HCO3
- determine state of compensation, if any

27 Review of nursing responsibilities in ABG analysis
- Nurse is responsible for identifying high risk populations for respiratory acidosis and alkalosis
- uses analysis to identify deviations from norm
- implements appropriate plans of care for acid-base imbalance to assist in restoration
- measures client’s response to treatment plan be evaluating the resolution of s/s of disorder and evidence of compensation