Respiratory Alkalosis (primary hypocapnia)
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Characterized by:

- Decreased PCO2
- Increased pH
- Decrease in [HCO3-]

Metabolic Compensation in Respiratory Alkalosis

- Acute resp alkalosis: decrease of 0.25mEq/L in [HCO3-] for each 1mmHg decrease in PCO2 is expected
- Chronic resp alkalosis: a 0.55mEq/L decrease in [HCO3-] is expected for each 1mmHg decrease in PCO2
    - pH is normal or near normal, but normalization of pH can take up to 4 weeks to be achieved

Causes of Respiratory Alkalosis

1. Hypoxemia
    - When pO2 decreases to <60mmHg the peripheral chemoreceptors mediate an increase in rate and depth of breathing → resulting in hypocapnia
    - Decreased oxygen *delivery* also results in hypocapnia
2. Pulmonary disease
    - Hyperventilation can be a result of concurrent hypoxemia
    - Pulmonary disease may cause hyperventilation *without hypoxemia* as a result of stimulation of *stretch receptors* and *nociceptive receptors* that respond to irritants, interstitial edema, fibrosis or pulmonary capillary congestion
        i. Stretch receptors: located in smooth muscle of tracheobronchial tree
        ii. Nociceptive receptors: include irritant receptors in the epithelium of small airways and juxtacapillary receptors lining capillaries in interstitium
3. Centrally mediated hyperventilation
4. Overzealous mechanical ventilation
5. Muscle metaboreceptor overactivity
6. Situations causing pain, fear or anxiety

Clinical Features

- Alkalemia results in arteriolar vasoconstriction that decreases cerebral and myocardial perfusion
- Hyperventilation (PCO2 < 25mmHg) causes decreased cerebral blood flow
- Hypocapnia decreases blood pressure and cardiac output in *anesthetized* but not awake subjects
    - Anesthetics blunt reflex tachycardia
- Alkalemia predisposes to refractory supraventricular and ventricular arrhythmias (especially in patients with preexisting heart disease)
- Acute alkalemia shifts oxygen hemoglobin dissociation curve to the left, reducing release of oxygen to the tissues by increasing affinity of hemoglobin for oxygen
    - Chronic alkalemia negates this effect by increasing concentration of 2,3-DPG in red cells
- Hypokalemia may occur as a result of translocation of potassium into cells and renal and extrarenal losses in patients with acute respiratory alkalosis

Box 11-4 Causes of Respiratory Alkalosis

Hypoxemia (Stimulation of Peripheral Chemoreceptors by Decreased Oxygen Delivery)
- Right-to-left shunting
- Decreased P_{IO_2} (e.g., high altitude)
- Congestive heart failure
- Severe anemia
- Severe hypotension
- Decreased cardiac output
- Pulmonary diseases with ventilation-perfusion mismatch
  - Pneumonia
  - Pulmonary thromboembolism
  - Pulmonary fibrosis
  - Pulmonary edema
  - Acute respiratory distress syndrome

Pulmonary Disease (Stimulation of Stretch/nociceptors Independent of Hypoxemia)
- Pneumonia
- Pulmonary thromboembolism
- Interstitial lung disease
- Pulmonary edema
- Acute respiratory distress syndrome

Centrally Mediated Hyperventilation
- Liver disease
- Hyperadrenocorticism
- Gram-negative sepsis
- Drugs
  - Salicylates
  - Corticosteroids
  - Progesterone (pregnancy)
  - Xanthines (e.g., aminophylline)
- Recovery from metabolic acidosis
- Central neurologic disease
  - Trauma
  - Neoplasia
  - Infection
  - Inflammation
  - Cerebrovascular accident
- Exercise
- Heatstroke

Muscle Metaboreceptor Overactivity
- Heart failure

Overzealous Mechanical Ventilation

Situations Causing Pain, Fear, or Anxiety

Questions

1. Name 3 causes of respiratory alkalosis
2. Fill in the blanks. Acute alkalemia shifts oxygen hemoglobin dissociation curve to the _____, but chronic alkalemia negates this effect by increasing concentration of _____ in _____ cells.