RESPIRATORY ALKALOSIS

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IMMEDIATE CONSIDERATIONS

FINDINGS

- **Signs & Symptoms**
    - Hyperventilation causing:
        - Light-headedness
        - Paresthesias
        - Tetany
    - Acute onset of hypocapnia can cause cerebral vasoconstriction and consequent neurologic symptoms like:
        - Dizziness
        - Mental confusion
        - Syncope
        - Sometimes even seizures
- **Lab Findings**
    - Elevated arterial blood pH
    - Low PCO_2
- **Determining compensation**
    - **Acute**
        - pH increases by 0.08 units, and HCO_3 decreases by 2 mEq/L per 10 mmHg decrease in $PaCO_2$ (up to a $PaCO_2$ of 20)
    - **Chronic**
        - pH increases by 0.03 units, and HCO_3 decreases by 5 mEq/L per 10 mmHg decrease in $PaCO_2$ (up to a $PaCO_2$ of 20)

        - Renal compensation occurs via decrease in renal acid secretion and subsequent decrease in serum bicarb
            - In contrast to respiratory acidosis, in long-standing respiratory alkalosis, pH can return to normal

- **Predisposing Conditions**
    - Hypoxia
    - Anxiety hyperventilation syndrome
    - Cerebrovascular accident
    - Salicylates
    - Nicotine
    - Xanthines
    - Progesterone of pregnancy
    - Central nervous system infections
    - Trauma and tumors
    - Sepsis
    - Hepatic failure
    - Recovery phase of metabolic acidosis
    - Heat exposure and lung disease
        - Pneumonia
        - Pulmonary embolism
        - Pulmonary edema
        - Interstitial lung disease

- **Differential Diagnoses**
    - Pinpoint the possible precipitating cause and identify if respiratory alkalosis is acute or chronic

DIAGNOSTIC INTERVENTIONS

- **Severity Score**
    - Based on the degree of elevation of arterial pH and mental status
- **Labs**
    - Arterial blood gases show:
        - Elevated pH
        - Low PCO_2
    - Chronic respiratory alkalosis may cause decreased serum bicarbonate
    - If sepsis is the probable etiology, check:
        - Serum chemistries
        - Complete blood count
        - Liver function tests
        - Serum and urine toxicology screen
            - In particular, presence of salicylate and amphetamine
        - Blood culture
        - Sputum
        - Urine
- **Monitoring**
    - Frequency of monitoring blood gases depends on degree of alkalosis and clinical assessment
    - ECG to monitor QT interval in hypocalcemia
- **Imaging**
    - Chest x-ray
    - Head CT/MRI
        - Based on suspicion of underlying disorder
    - Echocardiography can be performed to assess myocardial and valvular function

- A "bubble" study may help to evaluate unexplained hypoxemia and shunting
- Ventilation perfusion scans
    - If pulmonary embolism is suspected

THERAPEUTIC INTERVENTIONS

- Treat the underlying cause
    - In anxiety hyperventilation syndrome, reassurance, sedation, and breathing retraining are important
        - AVOID breathing into a paper bag
        - Beta blocker may have a role with its antiadrenergic action
    - In ventilated patients, reduce the tidal volume and respiratory rate
    - Treatment is usually not indicated unless the pH level is greater than 7.5
- **Contact/Consult**
    - Nephrologist
    - Toxicologist
        - If poisoning is suspected
    - Pulmonologist or neurologist
        - Depending on suspected etiology

MANAGEMENT AFTER STABILIZATION

- **Follow-Up**
    - Respiratory alkalemia causes muscle weakness
        - Will limit the hyperventilation by itself
            - Hence do not overcorrect
- **Further Treatment**

- Acute hypocalcaemia can be treated with IV calcium gluconate

- **Manage Complications**
  - Beware that too-rapid correction of chronic respiratory alkalosis can cause metabolic acidosis

CAUTIONS

- **Complications**
  - Tetany from hypocalcemia resulting from alkalosis
  - Hypocalcaemia may cause seizures and myocardial dysfunction
  - Over correction of respiratory alkalosis causing metabolic acidosis

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