RESPIRATORY ACIDOSIS

(Last updated 07/24/2019; Reviewers: Vimal Ravi, MD)

IMMEDIATE CONSIDERATIONS

FINDINGS

• Signs & Symptoms
  o Symptoms may develop acutely or slowly depending on the degree of hypercapnia and whether the condition is acute or chronic
  o Patients are usually:
    o Anxious
    o Dyspneic
  o Develop symptoms of carbon dioxide narcosis like:
    ▪ Delirium
    ▪ Somnolence
    ▪ Confusion
    ▪ Obtundation
  o Look for:
    ▪ Mental status changes
    ▪ Possible digital clubbing
    ▪ Cyanosis
    ▪ Diffuse wheeze
    ▪ Hyper inflated chest

• Lab Findings
  o Decreased pH (< 7.35) on ABG analysis
  o The presence of an increased partial pressure of arterial carbon dioxide (PaCO₂) (>45 mm Hg)
• **Formulae for calculating compensation:**
  - Acute
    - pH drops by 0.08 units, and HCO3 increases by 1 mEq/L per 10 mmHg increase in PaCO2
  - Chronic
    - pH drops by 0.03 units, and HCO3 increases by 3-4 mEq/L per 10 mmHg increase in PaCO2

• **Predisposing Conditions**
  - COPD
  - Neuromuscular diseases
  - Chest wall disorders
  - Obesity hypoventilation syndrome
  - Obstructive sleep apnea
  - CNS depression
    - Including opioid overdose and alcohol intoxication
  - Head trauma
  - Intracranial hemorrhage
  - Cerebral edema
  - Increased intracranial pressure
  - Tracheal stenosis
  - Lung protective mechanical ventilation

• **Differential Diagnoses**
  - Identify specific etiology amongst the conditions listed above

**DIAGNOSTIC INTERVENTIONS**
- **Severity Score**
  - May require ICU admission if patient has:
    - Patient confusion
    - Lethargy
    - Respiratory muscle fatigue
    - Low pH (< 7.25)
  - All patients who require tracheal intubation and mechanical ventilation must be admitted to the ICU

- **Labs**
  - ABG
  - Electrolytes
  - Drug and toxicology screen

- **Monitoring**
  - Mental status
  - Blood gases

- **Imaging**
  - Chest x-ray or CT based on suspected underlying condition
    - CT head if suspect intracranial pathology

**THERAPEUTIC INTERVENTIONS**

- Oxygen supplemental

- **Medications**
  - Beta₂ agonists
    - Albuterol
  - Inhaled short-acting anticholinergic medication ipratropium
o Inhaled glucocorticoids
  ▪ Budesonide
  ▪ Fluticasone
  ▪ Mometasone

o Systemic glucocorticoids
  ▪ Methylprednisolone
  ▪ Prednisone
  ▪ Prednisolone

o Flumazenil
  ▪ In iatrogenic benzodiazepine overdose

o Naloxone
  ▪ In opioid overdose

• Procedures
  o May require non-invasive ventilation or tracheal intubation and mechanical ventilation

• Contact/Consult
  o Pulmonologist

• Anxiolysis & Sedation
  o For patients on mechanical ventilation, may need to consider sedation

MANAGEMENT AFTER STABILIZATION

• Further Treatment
  o Treat underlying etiology

• Manage Complications
  o If the patient is intubated, use lung protective ventilation strategies
CAUTIONS

- Complications
  
  o Rapid correction of the hypercapnia by the application of external noninvasive positive-pressure ventilation or invasive mechanical ventilation can result in alkalemia
  
  o Oxygen therapy should be used with caution because it may worsen hypercapnia in some situations due to ventilation perfusion mismatch and the Haldane effect
  
  o Hypercapnia is best avoided by titrating FiO2 to maintain oxygen saturation approximately 88-92 percent
REFERENCES & ACKNOWLEDGMENTS

Acknowledgement: Suartcha Prueksaritanond, MD; Alexander Kogan, MD

