

# Hypocarbia

A decrease in PaCO<sub>2</sub> or ETCO<sub>2</sub> greater than expected for the associated minute ventilation; associated sequelae (respiratory alkalosis) and the potential for life threatening etiology. Requires simultaneous diagnosis and treatment.

## ANESTHETIC CONSIDERATIONS:

- Machine and circuit
    - Sampling error
    - Kinked sample line
    - Obstructed sample line
  - Airway\*
    - Malpositioned
      - No airway → No EtCO<sub>2</sub>
      - Endobronchial → will initially ↓ EtCO<sub>2</sub> until HPV
    - kinked ETT
  - Patient problems
    - Hyperventilation
    - Increased Dead space\*
      - ↓ CO
      - severe hypovolemia
      - obstruction to pulmonary flow → VAE, Pulmonary Embolism, Fat Embolism, Amniotic Fluid Embolism
    - Increased shunt\*
      - atelectasis
      - Pneumothorax
      - CHF
      - pneumonia / aspiration
      - hyperinflation
    - Decreased CO<sub>2</sub> production
      - hypothermia
      - hypothyroidism
- = will increase PaCO<sub>2</sub> – EtCO<sub>2</sub> gradient

## ANESTHETIC GOALS:

- Simultaneously diagnose and treat a potentially life threatening emergency.
- Prevention and detection of early manifestations and sequelae

## ETIOLOGY

### H. Decreased CO<sub>2</sub> production

- **Decreased metabolic rate**
  - Hypothermia
  - Hypothyroidism
  - Poor cardiac output

### I. Increased CO<sub>2</sub> elimination

- **Hyperventilation**

### J. Impaired CO<sub>2</sub> delivery to pulmonary circulation

- **V/Q mismatch (increased dead space ventilation – causes increased PaCO<sub>2</sub> vs ETCO<sub>2</sub>)**
  - Pulmonary embolus
  - Fat embolus
  - Air embolus
  - Amniotic fluid embolus
  - Atelectasis
  - Pneumothorax
  - Intracardiac shunt
  - Etc.

## MANIFESTATIONS

- Sudden decrease in ETCO<sub>2</sub> with or without associated decreased PaCO<sub>2</sub> on ABG
  - Respiratory alkalosis and associated sequelae

## MANAGEMENT

- Increase FiO<sub>2</sub> to 100%
- Assess hemodynamics
- Check monitors (ETCO<sub>2</sub>)
- Check that ventilation is adequate and not hyperventilating
  - Check end-tidal CO<sub>2</sub>
  - Increase respiratory rate and assess for decrease in ETCO<sub>2</sub> with increased minute ventilation
  - Switch to hand ventilation to assess pulmonary compliance
  - Hand ventilate with large tidal volumes to expand collapsed lung segments (recruitment maneuver)
  - Auscultate the breath sounds bilaterally, assess the adequacy and symmetry of chest movement

- Obtain ABGs
- Check the position of the ETT
  - Auscultation
  - Direct visualization of ETT at mouth opening
  - Direct visualization of ETT cuff below cords
  - Fiberoptic bronchoscopy to visualize tracheal rings and the carina
  - Adjust the position of the ETT if necessary
- Notify surgeon if continuing to have issues
  - Especially if hemodynamic issues +/- obstructive shock/low output state
  - Stop any aggravating surgical stimulus (insufflation, reaming, etc.)
- Support hemodynamics as necessary

#### **PREVENTION**

- Perform a careful check of the anesthesia machine, ETCO<sub>2</sub>, CO<sub>2</sub> absorbant, and alarms before use
- Maintain adequate ventilation, using appropriate clinical and electronic monitors

#### **COMPLICATIONS**

- Respiratory alkalosis
- Arrhythmias
- Hypotension/hypertension
- Bradycardia/tachycardia

#### **REFERENCES**

- Crisis Management in Anesthesiology