UNIT TERMINAL OBJECTIVE
5-1 At the end of this unit, the EMT-Critical Care Technician student will be able to utilize the assessment findings to formulate a field impression and implement the treatment plan for the patient with respiratory emergencies.

COGNITIVE OBJECTIVES
At the completion of this unit, the EMT-Critical Care Technician will be able to:

5-1.1 Identify and describe the function of the structures located in the upper and lower airway. (C-1)
5-1.2 Discuss the physiology of ventilation and respiration. (C-1)
5-1.3 Identify common pathological events that affect the pulmonary system. (C-1)
5-1.4 Discuss abnormal assessment findings associated with pulmonary diseases and conditions. (C-1)
5-1.5 Compare various airway and ventilation techniques used in the management of pulmonary diseases. (C-3)
5-1.6 Review the pharmacological preparations that EMT-Critical Care Technicians use for management of respiratory diseases and conditions. (C-1)
5-1.7 Review the use of equipment used during the physical examination of patients with complaints associated with respiratory diseases and conditions. (C-1)
5-1.8 Describe the epidemiology, pathophysiology, assessment findings, and management for the following respiratory diseases and conditions: (C-1)
   a. Bronchial asthma
   b. Chronic bronchitis
   c. Emphysema
   d. Pneumonia
   e. Pulmonary edema
   f. Spontaneous pneumothorax
   g. Hyperventilation syndrome
   h. Pulmonary thromboembolism

AFFECTIVE OBJECTIVES
At the completion of this unit, the EMT-Critical Care Technician will be able to:

5-1.9 Recognize and value the assessment and treatment of patients with respiratory diseases. (A-2)
5-1.10 Indicate appreciation for the critical nature of accurate field impressions of patients with respiratory diseases and conditions. (A-2)

PSYCHOMOTOR OBJECTIVES
At the completion of this unit, the EMT-Critical Care Technician will be able to:

5-1.11 Demonstrate and record pertinent assessment findings associated with pulmonary diseases and conditions. (P-1)
5-1.12 Review proper use of airway and ventilation devices. (P-1)
5-1.13 Conduct a simulated history and patient assessment, record the findings, and report appropriate management of patients with pulmonary diseases and conditions. (P-3)
DECLARATIVE

I. Introduction
II. Anatomy and physiology review
   A. Anatomy review
      1. Upper airway
      2. Lower airway
   B. Global physiology of the pulmonary system
      1. Function
         a. The respiratory system functions as a gas exchange system
         b. 10,000 liters of air are filtered, warmed, humidified, and exchanged daily in adults
         c. Oxygen is diffused into the bloodstream for use in cellular metabolism by the body’s
            100 trillion cells
         d. Wastes, including carbon dioxide, are excreted from the body via the respiratory
            system
      2. Physiology
         a. Ventilation
         b. Diffusion
         c. Perfusion
   III. General system pathophysiology, assessment, and management
       A. Pathophysiology
          1. A variety of problems can impact the pulmonary system’s ability to achieve its goal of gas
             exchange to provide for cellular needs and excretion of wastes
          2. Understanding these problems globally can enable the EMT-Critical Care Technician to
             quickly and effectively pinpoint probably causes and necessary interventions
          3. Specific pathophysiologies
             a. Ventilation
                (1) Upper airway obstruction
                   (a) Trauma
                   (b) Epiglottitis
                   (c) Foreign body obstruction
                   (d) Inflammation of the tonsils
                (2) Lower airway obstruction
                   (a) Trauma
                   (b) Obstructive lung disease
                   (c) Mucous accumulation
                   (d) Smooth muscle spasm
                   (e) Airway edema
                (3) Chest wall impairment
                   (a) Trauma
                   (b) Hemothorax
                   (c) Pneumothorax
                   (d) Empyema
                   (e) Pleural inflammation
                   (f) Neuromuscular diseases (such as multiple sclerosis or muscular dystrophy)
                (4) Problems in neurologic control
                   (a) Brainstem malfunction
                      i) CNS depressant drugs
                      ii) CVA or other medical neurologic condition
b. Diffusion
   (1) Inadequate oxygen concentration in ambient air
   (2) Alveolar pathology
       (a) Asbestosis, other environmental lung diseases
       (b) Blebs/ bullae associated with chronic obstructive lung disease
       (c) Inhalation injuries
   (3) Interstitial space pathology
       (a) Pulmonary edema
           i) High pressure (also known as cardiogenic)
               a) Left heart failure
               b) Idiopathic pulmonary hypertension
           ii) High permeability (also known as non-cardiogenic)
               a) Acute Respiratory Distress Syndrome (ARDS)
               b) Environmental lung diseases i.e. asbestosis,
               c) Near-drowning
               d) Post-hypoxia
               e) Inhalation injuries
   c. Perfusion
      (1) Inadequate blood volume/ hemoglobin levels
          (a) Hypovolemia
          (b) Anemia
      (2) Impaired circulatory blood flow
          (a) Pulmonary embolus
      (3) Capillary wall pathology
          (a) Trauma

B. Assessment Findings
   1. Scene size up
      a. Pulmonary complaints may be associated with exposure to a wide variety of toxins,
         including carbon monoxide, toxic products of combustion, or environments which
         have deficient ambient oxygen (e.g., silos, enclosed storage spaces)
      b. It is critical to assure a safe environment for all EMS personnel before initiating
         patient contact
      c. If necessary, individuals with specialized training and equipment should be utilized
         to remove the patient from a hazardous environment
   2. Initial assessment
      a. A major focus of the initial assessment is the recognition of life-threat; there are a
         variety of pulmonary conditions which may offer a very real risk for patient death
      b. Recognition of life-threat and the initiation of resuscitation takes priority over
         detailed assessment
      c. Signs of life-threatening respiratory distress in adults, listed from most ominous to
         least severe
         (1) Alterations in mental status
         (2) Severe cyanosis
         (3) Absent breath sounds
         (4) Audible stridor
         (5) 1-2 word dyspnea
(6) Tachycardia > 130 beats/minute
(7) Pallor and diaphoresis
(8) The presence of retractions/use of the accessory muscles

3. Focused history and physical examination
   a. Chief complaint
      (1) Dyspnea
      (2) Chest pain
      (3) Cough
         (a) Productive
         (b) Non-productive
         (c) Hemoptysis
      (4) Wheezing
      (5) Signs of infection
         (a) Fever/chills
         (b) Increased sputum production
   b. History
      (1) Previous experiences with similar/identical symptoms
         (a) The patient’s subjective description of acuity is an accurate
             indicator of the acuity of this episode if the pathology is chronic
         (b) Asking the patient “what happened the last time you had an attack
             this bad” is an extremely useful predictor of this episode’s course
      (2) Known pulmonary diagnosis
         (a) If the diagnosis is not known to the EMT-Critical Care Technician,
             an effort should be made to learn whether it is primarily related to
             ventilation, diffusion, perfusion, or a combination
      (3) History of previous intubation is an accurate indicator of severe pulmonary
          disease, and suggests that intubation may be required again
      (4) Medication history
         (a) Current medications
         (b) Medication allergies
         (c) Pulmonary medications
            i) Sympathomimetic
               a) Inhaled
               b) Oral
               c) Parenteral
            ii) Corticosteroid
               a) The presence of corticosteroid in the patient’s
                  home regimen strongly suggests severe, chronic
                  disease
               b) Inhaled
               c) Oral (daily versus during exacerbations only)
               d) Chromolyn sodium
               e) Methylxanthines (theophylline preparations)
               f) Antibiotics
         (d) Cardiac-related drugs
      (5) History of the present episode
      (6) Exposure/smoking history
   c. Physical exam
      (1) General impression
         (a) Position
(b) Mentation
i) Confusion is a sign of hypoxemia or hypercarbia
ii) Restlessness and irritability may be signs of fear and hypoxemia
iii) Severe lethargy or coma is a sign of hypercarbia
(c) Ability to speak
i) 1-2 word dyspnea versus ability to speak freely
ii) Rapid, rambling speech is a sign of anxiety and fear
(d) Respiratory effort
i) Hard work indicates obstruction
ii) Retractions
iii) Use of accessory muscles
(e) Color
i) Pallor
ii) Diaphoresis
iii) Cyanosis
   a) Central
   b) Peripheral

(2) Vital signs
(a) Pulse
i) Tachycardia is a sign of hypoxemia and the use of sympathomimetic medications
ii) In the face of a pulmonary etiology, bradycardia is an ominous sign of severe hypoxemia and imminent cardiac arrest
(b) Blood pressure
i) Hypertension may be associated with sympathomimetic medication use
(c) Respiratory rate
i) The respiratory rate is not a very accurate indicator of respiratory status unless it is very slow
ii) Trends are essential in evaluating the chronic patient.
   a) Slowing rate in the face of an unimproved condition suggests exhaustion and impending respiratory insufficiency
(d) Respiratory patterns
i) Eupnea
ii) Tachypnea
iii) Cheyne-Stokes
iv) Central neurogenic hyperventilation
v) Kussmaul
vi) Ataxic (Biot’s)
vii) Apneustic
viii) Apnea

(3) Head/ neck
(a) Pursed lip breathing
(b) Use of accessory muscles
(c) Sputum
   i) Increasing amounts suggest infection
   ii) Thick, green, or brown sputum suggests infection and/or pneumonia
   iii) Yellow or pale gray sputum may be related to allergic or inflammatory etiologies
   iv) Frank hemoptysis often accompanies severe tuberculosis or carcinoma
   v) Pink, frothy sputum is associated with severe, late stages of pulmonary edema

(d) Jugular venous distention may accompany right-sided heart failure, which may be caused by severe pulmonary obstruction

(4) Chest
   (a) Signs of trauma
   (b) Barrel chest demonstrates the presence of long-standing chronic obstructive lung disease
   (c) Retractions
   (d) Symmetry
   (e) Breath sounds
      i) Normal
      ii) Abnormal
         a) Stridor
         b) Wheezing
         c) Rhonchi (low wheezes)
         d) Rales (crackles)

(5) Extremities
   (a) Peripheral cyanosis
   (b) Carpopedal spasm may be associated with hypocapnia resulting from periods of rapid, deep respiration

d. Diagnostic testing
   (1) Pulse oximetry
      (a) Used to evaluate or confirm the adequacy of oxygen saturation
      (b) May be inaccurate in the presence of conditions which abnormally bind hemoglobin, including carbon monoxide poisoning or methemoglobinemia
   (2) Peak flow
      (a) Provides a baseline assessment of airflow for patients with obstructive lung disease
   (3) Capnometry
      (a) Provides ongoing assessment of endotracheal tube position; end-tidal CO₂ drops immediately when the tube is displaced from the trachea
      (b) Quantitative versus qualitative

C. Management
   1. Airway and ventilatory support
      a. Manual airway opening maneuvers
      b. Oropharyngeal airway
      c. Nasopharyngeal airway
      d. Nasal cannula
      e. Simple oxygen mask
Medical: 5
Respiratory Emergencies: 1

f. Non-rebreather mask
g. Multi-lumen airway
h. Bag-valve-mask
i. Suctioning
j. Endotracheal tube
k. Oxygen powered manually triggered ventilators
l. Automatic transport ventilator

2. Circulatory support

3. Pharmacological interventions
   a. Oxygen
   b. Sympathomimetic
      (1) Beta 2 agonists (e.g., albuterol - Proventil, Ventolin, metaproterenol sulfate - Alupent)
      (2) Epinephrine

4. Non-pharmacological interventions
   a. Positioning - sitting up
   b. Back blows

5. Monitoring and devices
   a. Pulse oximetry
   b. Peak flow
   c. Capnometry

6. Transport considerations
   a. Appropriate mode
   b. Appropriate facility

7. Psychological support/ communication strategies

IV. Specific illness
A. Obstructive airway disease
   1. A spectrum of diseases which affect a substantial number of individuals worldwide
   2. Diseases include asthma, COPD (which includes emphysema and chronic bronchitis)
   3. Epidemiology
      a. Morbidity/ mortality
         (1) Overall
         (2) Asthma - 4-5% of US population
         (3) 20% of adult males have chronic bronchitis
      b. Causative factors
         (1) Cigarette smoking
         (2) Exposure to environmental toxins
         (3) Genetic predisposition
      c. Factors which may exacerbate underlying conditions
         (1) Intrinsic
            (a) Stress is a significant exacerbating factor, particularly in adults
            (b) Upper respiratory infection
            (c) Exercise
         (2) Extrinsic
            (a) Tobacco smoke
            (b) Allergens (including foods, animal danders, dusts, molds, pollens)
            (c) Drugs
            (d) Occupational hazards
   4. Pathophysiology overview
      a. Obstruction occurs in the bronchioles, and may be the result of
(1) Smooth muscle spasm  
   (a) Beta receptors  
(2) Mucous  
   (a) Goblet cells  
   (b) Cilia  
(3) Inflammation  

b. Obstruction may be reversible or irreversible  
c. Obstruction causes air trapping through the following mechanism  
   (1) Bronchioles dilate naturally on inspiration  
   (2) Dilation enables air to enter the alveoli despite the presence of obstruction  
   (3) Bronchioles naturally constrict on expiration  
   (4) Air becomes trapped distal to obstruction on exhalation  

5. Specific pathophysiology  
a. Asthma  
   (1) Reversible obstruction  
   (2) Obstruction caused by a combination of smooth muscle spasm, mucous, and edema  
   (3) Exacerbating factors tend to be extrinsic in children, intrinsic in adults  
   (4) Status asthmaticus - prolonged exacerbation which does not respond to therapy  
b. Chronic bronchitis  
   (1) Reversible and irreversible obstruction  
   (2) Characterized by hyperplasia and hypertrophy of mucous-producing glands  
   (3) Clinical definition - productive cough for at least 3 months per year for 2 or more consecutive years  
   (4) Typically associated with cigarette smoking, but may also occur in non-smokers  
c. Emphysema  
   (1) Irreversible airway obstruction  
   (2) Diffusion defect also exists because of the presence of blebs  
   (3) Because blebs have extremely thin walls, they are prone to collapse  
   (4) To prevent collapse, the patient often exhales through pursed lips, effectively maintaining a positive airway pressure  
   (5) Almost always associated with cigarette smoking or significant exposure to environmental toxins  

6. Assessment findings  
a. Signs of severe respiratory impairment  
   (1) Altered mentation  
   (2) 1-2 word dyspnea  
   (3) Absent breath sounds  
b. Chief complaint  
   (1) Dyspnea  
   (2) Cough  
   (3) Nocturnal awakening with dyspnea and wheezing  
c. History  
   (1) Personal or family history of asthma and/or allergies  
   (2) History of acute exposure to pulmonary irritant  
   (3) History of prior similar episodes  
d. Physical findings  
   (1) Wheezing may be present in ALL types of obstructive lung disease
(2) Retractions and/or use of accessory muscles
e. Diagnostic testing
   (1) Pulse oximeter to document degree of hypoxemia and response to therapy
   (2) Peak flow to establish baseline airflow

7. Management
   a. Airway and ventilatory support
      (1) Intubation as required
      (2) Assisted ventilation may be necessary
      (3) High flow oxygen
   b. Circulatory support
      (1) Intravenous therapy may be necessary to
      (a) Improve hydration
      (b) Thin and loosen mucous
   c. Pharmacological interventions
      (1) Beta 2 agonists
   d. Transport considerations
      (1) Appropriate mode
      (2) Appropriate facility
      (3) Continue monitoring
      (4) Contact medical direction
   e. Psychological support/ communication strategies

B. Pneumonia

1. Epidemiology
   a. Incidence
      (1) Fifth leading cause of death in the US
      (2) Not a single disease, but a group of specific infections
   b. Risk factors
      (1) Cigarette smoking
      (2) Alcoholism
      (3) Exposure to cold
      (4) Extremes of age (old or young)

2. Anatomy and physiology review
   a. Cilia
   b. Causes and process of mucous production

3. Pathophysiology
   a. Ventilation disorder
   b. Infection of lung parenchyma
      (1) Most commonly bacterial
      (2) May also be viral or fungal
   c. May cause alveolar collapse (atelectasis)
   d. Localized inflammation/infection may become systemic, leading to sepsis and septic shock
   e. Community acquired versus hospital acquired

4. Assessment findings
   a. Typical pneumonia
      (1) Acute onset of fever and chills
      (2) Cough productive of purulent sputum
      (3) Pleuritic chest pain (in some cases)
      (4) Pulmonary consolidation on auscultation
      (5) Location of bronchial breath sounds
(6) Rales
b. Atypical pneumonia
   (1) Non-productive cough
   (2) Extra-pulmonary symptoms
   (3) Headache
   (4) Myalgias
   (5) Fatigue
   (6) Sore throat
   (7) Nausea, vomiting, diarrhea
   (8) Fever and chills

5. Management
   a. Airway and ventilatory support
      (1) Intubation may be required
      (2) Assisted ventilation as necessary
      (3) High flow oxygen
   b. Circulatory support
      (1) Intravenous access
      (2) Administration of IV fluids
         (a) Improve hydration
         (b) Thin and mobilize mucous
   c. Pharmacological interventions
      (1) Beta 2 agonists may be required if airway obstruction is severe or if the patient has accompanying obstructive lung disease
   d. Non-pharmacological interventions
      (1) Cool if high fever
   e. Transport considerations
      (1) Appropriate mode
      (2) Appropriate facility
   f. Psychological support/communication strategies

C. Pulmonary edema
1. Not a disease, but a pathophysiological condition
   a. High pressure (cardiogenic)
   b. High permeability (non-cardiogenic)

2. Epidemiology
   a. Risk factors vary based on type
      (1) High pressure (cardiogenic)
         (a) Acute myocardial infarction
         (b) Chronic hypertension
         (c) Myocarditis
      (2) High permeability (non-cardiogenic)
         (a) Acute hypoxemia
         (b) Near-drowning
         (c) Post cardiac arrest
         (d) Post shock
         (e) High altitude exposure
         (f) Inhalation of pulmonary irritants
         (g) Adult Respiratory Distress Syndrome (ARDS)

3. Anatomy and physiology review
4. Pathophysiology
   a. Diffusion disorder
b. High pressure (cardiogenic)
(1) Left-sided heart failure
(2) Increase pulmonary venous pressure
(3) Increase in hydrostatic pressure
(4) Engorgement of pulmonary vasculature
(5) Failure of cough and lymphatics to drain fluids
(6) Excessive accumulation of fluid in the interstitial space
(7) Widening interstitial space impairs diffusion
(8) In severe cases, fluid may accumulate in the alveoli

c. High permeability (non-cardiogenic)
(1) Disruption of the alveolar-capillary membranes caused by
   (a) Severe hypotension
   (b) Severe hypoxemia (post drowning, post cardiac arrest, severe seizure, prolonged hypoventilation)
   (c) High altitude
   (d) Environmental toxins
   (e) Septic shock
(2) Disrupted membranes leak fluid into the interstitial space
(3) Widened interstitial space impairs diffusion

5. Assessment findings
a. High pressure (cardiogenic)
(1) Refer to Cardiac Emergencies unit
b. High permeability (non-cardiogenic)
(1) History of associated factors
   (a) Hypoxic episode
   (b) Shock (hypovolemic, septic, or neurogenic)
   (c) Chest trauma
   (d) Recent acute inhalation of toxic gases or particles
   (e) Recent ascent to high altitude without acclimatizing
(2) Dyspnea
(3) Orthopnea
(4) Fatigue
(5) Reduced exercise capacity
(6) Pulmonary rales, particularly in severe cases
c. Diagnostic testing

6. Management
a. High pressure (cardiogenic)
(1) Airway and ventilatory support
   (a) Intubation as necessary
   (b) Assisted ventilation as necessary
   (c) High flow oxygen
(2) Circulatory support
   (a) Avoid fluid excess; monitor IV flow rates carefully
(3) Pharmacological interventions
   (a) Nitroglycerine
   (b) Furosemide
   (c) Morphine sulfate
(4) Non-pharmacological interventions
   (a) Position the patient in an upright position with legs dangling
(5) Transport decisions
(a) Appropriate mode
(b) Appropriate facility

(6) Psychological support/communication strategies
b. High permeability (non-cardiogenic)
   (1) Airway and ventilatory support
      (a) Intubation as necessary
      (b) Assisted ventilation as necessary
      (c) High flow oxygen
   (2) Circulatory support
      (a) Avoid fluid excess; monitor IV flow rates carefully
   (3) Pharmacological interventions
   (4) Non-pharmacological interventions
      (a) Position the patient in an upright position with legs dangling
      (b) Rapid removal from any environmental toxins
      (c) Rapid descent in altitude if high altitude pulmonary edema (HAPE) is suspected
   (5) Transport considerations
      (a) Appropriate mode
      (b) Appropriate facility
   (6) Psychological support/communication strategies

D. Pulmonary thromboembolism
1. Epidemiology
   a. Incidence
      (1) Responsible for 50,000 death annually
      (2) 5% of sudden deaths
   b. Morbidity/mortality
      (1) Less than 10% of pulmonary emboli result in death
   c. Risk factors
      (1) Recent surgery
      (2) Pregnancy
      (3) Oral contraceptives
      (4) Infection
      (5) Cancer
      (6) Sickle cell anemia
      (7) Long bone fractures
      (8) Prolonged inactivity
      (9) Bedridden

2. Anatomy and physiology review
3. Pathophysiology
   a. Perfusion disorder
   b. Deep vein stasis
   c. Injury to vein wall
   d. Hypercoagulability
   e. Platelet aggregation
   f. Embolism size
   g. Embolism location in the legs
   h. Embolism location in the lungs
   i. Complete loss of perfusion in some area of lungs
   j. Other causes of pulmonary circulation obstruction
      (1) Air
(2) Fat
(3) Foreign objects
(4) Venous catheters
(5) Amniotic fluid

4. Assessment findings - depend on size and location of the clot
   a. Evidence of significant life-threatening embolus in a proximal location
      (1) Altered mentation
      (2) Severe cyanosis
      (3) Profound hypotension
      (4) Cardiac arrest
   b. Chief complaint
      (1) Chest pain
      (2) Dyspnea
      (3) Cough (typically non-productive)
   c. History
      (1) Sudden onset
      (2) Identification of risk factors
   d. Physical findings
      (1) Normal breath sounds or, in severe cases, rales
      (2) Pleural friction rub
      (3) Tachycardia
      (4) Clinical evidence of thrombophlebitis (found in less than 50%)
      (5) Tachypnea
      (6) Hemoptysis (fairly rare)

5. Management - prevention has major role in management
   a. Depends on the size of the embolism
   b. Airway and ventilatory support
      (1) Intubation as necessary
      (2) Positive pressure ventilation as necessary
      (3) High flow oxygen
   c. Circulatory support
      (1) CPR as necessary
      (2) IV therapy; hydration based on clinical symptoms
   d. Pharmacological interventions
   e. Non-pharmacological interventions
      (1) Support body systems
      (2) Most severe cases will be managed as a cardiac arrest of unknown origin
   f. Transport considerations
      (1) Appropriate mode
      (2) Appropriate facility
   g. Psychological support/ communication strategies

E. Spontaneous pneumothorax
   1. Epidemiology
      a. Incidence
         (1) 18 per 100,000
      b. Morbidity/ mortality
         (1) 15-20% partial pneumothorax may be well tolerated
      c. Risk factors
         (1) Males
         (2) Younger age
2. Assessment findings
   a. Chief complaint
      (1) Shortness of breath
      (2) Chest pain
      (3) Sudden onset
   b. Physical findings
      (1) Typically minor
         (a) Pallor
         (b) Diaphoresis
         (c) Tachypnea
      (2) Severe
         (a) Altered mentation
         (b) Cyanosis
         (c) Tachycardia
         (d) Decreased unilateral breath sounds
         (e) Local hyperresonance to percussion
         (f) Subcutaneous emphysema

3. Management
   a. Airway and ventilatory support
      (1) Intubation as necessary
      (2) Assisted ventilation as necessary
      (3) Oxygen - administration levels based on symptoms and pulse oximetry
      (4) Watch for the development of a tension pneumothorax
   b. Circulatory support
      (1) IV initiation if severe symptoms present
   c. Pharmacological interventions
      (1) Not typically necessary; treat symptomatically
   d. Non-pharmacological interventions
      (1) Position of comfort/ best ventilation
      (2) Needle decompression if progression to a tension pneumothorax occurs
   e. Transport considerations
      (1) Appropriate mode
      (2) Appropriate facility
   f. Psychological support/ communication strategies

F. Hyperventilation syndrome
   1. Epidemiology
      a. Incidence is unknown
   2. Pathophysiology
      a. Tachypnea without physiologic demand for increased oxygen causes respiratory alkalosis
      b. Tachypnea caused by anxiety resulting in respiratory alkalosis
      c. Carbon dioxide is washed out and carbonic acid is reduced
         (1) Shift in the acid/ base balance occurs toward base
   3. Assessment findings
      a. Chief complaint
         (1) Dyspnea
         (2) Chest pain
      b. Physical findings
(1) Rapid breathing with high minute volume  
(2) Varying depending on cause of syndrome  
(3) Carpopedal spasms  

c. Caution there are multiple causes of tachypnea that are not hyperventilation syndrome but cause increased oxygen demand  
(1) Hypoxia  
(2) High altitude  
(3) Pulmonary disorders  
(4) Pneumonia  
(5) Pulmonary emboli, vascular disease  
(6) Bronchial asthma  
(7) Cardiovascular disorders  
(8) Congestive heart failure  
(9) Hypotension/ shock  
(10) Metabolic disorders  
(11) Acidosis  
(12) Hepatic failure  
(13) Neurologic disorders  
(14) Central nervous system infection, tumors  
(15) Drugs  
(16) Fever, sepsis  
(17) Pain  
(18) Pregnancy  

4. Management  
a. Depends on cause of syndrome  
b. Airway and ventilatory support  
   (1) Oxygen, rate of administration based on symptoms and pulse oximetry  
   (2) If anxiety hyperventilation is confirmed (especially based on patient’s prior history) coached ventilation/ rebreathing techniques might be considered  
c. Circulatory support  
   (1) Intervention rarely required  
d. Pharmacological interventions  
   (1) Intervention rarely required  
e. Non-pharmacological interventions  
   (1) Intervention rarely required  
   (2) Patients with anxiety hyperventilation will require psychological approaches to calm them  
   (3) Have them mimic your respiratory rate and volume  
   (4) Do not place bag over mouth and nose  
f. Transport considerations  
   (1) Appropriate mode  
   (2) Appropriate facility  
g. Psychological support/ communication strategies  
   (1) Depend on cause of hyperventilation