

### **UNIT TERMINAL OBJECTIVE**

- 5-1 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement the treatment plan for the patient with respiratory problems.

### **COGNITIVE OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-1.1 Discuss the epidemiology of pulmonary diseases and conditions. (C-1)
- 5-1.2 Identify and describe the function of the structures located in the upper and lower airway. (C-1)
- 5-1.3 Discuss the physiology of ventilation and respiration. (C-1)
- 5-1.4 Identify common pathological events that affect the pulmonary system. (C-1)
- 5-1.5 Discuss abnormal assessment findings associated with pulmonary diseases and conditions. (C-1)
- 5-1.6 Compare various airway and ventilation techniques used in the management of pulmonary diseases. (C-3)
- 5-1.7 Review the pharmacological preparations that paramedics use for management of respiratory diseases and conditions. (C-1)
- 5-1.8 Review the pharmacological preparations used in managing patients with respiratory diseases that may be prescribed by physicians. (C-1)
- 5-1.9 Review the use of equipment used during the physical examination of patients with complaints associated with respiratory diseases and conditions. (C-1)
- 5-1.10 Identify the epidemiology, anatomy, physiology, pathophysiology, assessment findings, and management for the following respiratory diseases and conditions: (C-1)
  - a. Adult respiratory distress syndrome
  - b. Bronchial asthma
  - c. Chronic bronchitis
  - 4. Emphysema
  - 5. Pneumonia
  - 6. Pulmonary edema
  - 7. Pulmonary thromboembolism
  - 8. Neoplasms of the lung
  - 9. Upper respiratory infections
  - 10. Spontaneous pneumothorax
  - 11. Hyperventilation syndrome

### **AFFECTIVE OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-1.11 Recognize and value the assessment and treatment of patients with respiratory diseases. (A-2)
- 5-1.12 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 paramedic student will be able to:

- 5-1.13 Demonstrate proper use of airway and ventilation devices. (P-1)
- 5-1.14 Conduct a history and patient assessment for patients with pulmonary diseases and conditions. (P-1)
- 5-1.15 Demonstrate the application of a CPAP/ BiPAP unit. (P-1)

## DECLARATIVE

- I. Introduction
  - A. Epidemiology
    1. Incidence
      - a) Respiratory complaints are a major aspect of EMS, resulting in 28% of all EMS chief complaints according to a US study of over 2.5 million EMS calls
    2. Mortality/ morbidity
      - a) Over 200,000 persons die from respiratory emergencies each year
    3. Risk factors
      - a) Intrinsic factors which increase the risk of developing respiratory disease
        - (1) Genetic predisposition
          - (a) Influences development of
            - (i) Asthma
            - (ii) COPD
            - (iii) Carcinomas
          - (2) Associated cardiac or circulatory pathologies
            - (a) Influences development of
              - (i) Pulmonary edema
              - (ii) Pulmonary emboli
            - (3) Stress
              - (a) Increases the severity of respiratory complaints
              - (b) May be associated with the frequency of exacerbations of asthma and COPD
          - b) Extrinsic factors which increase the risk of developing respiratory disease
            - (1) Smoking
              - (a) Increases the prevalence of COPD and carcinomas
              - (b) Increases the severity of virtually all respiratory disorders
            - (2) Environmental pollutants
              - (a) Increases the prevalence of COPD
              - (b) Increases the severity of all obstructive disorders
      - B. Anatomy and physiology review
        1. Global physiology of the pulmonary system
          - a) Function
            - (1) The respiratory system functions as a gas exchange system
            - (2) 10,000 liters of air are filtered, warmed, humidified, and exchanged daily in adults

- (3) Oxygen is diffused into the bloodstream for use in cellular metabolism by the body's 100 trillion cells
- (4) Wastes, including carbon dioxide, are excreted from the body via the respiratory system
- b) Physiology
  - (1) Ventilation
    - (a) Ventilation refers to the process of air movement in and out of the lungs
    - (b) In order for ventilation to occur, the following functions must be intact
      - (i) Neurologic control (brainstem) needs to initiate inspiration
      - (ii) Nerves between the brainstem and the muscles of respiration (diaphragm & intercostals) need to be intact and undamaged
      - (iii) Diaphragm and intercostal muscles must be functional and non-traumatized
      - (iv) Upper airways must be intact and patent
      - (v) Lower airways must be intact and patent
      - (vi) The alveoli must be intact and non-collapsed
    - (c) Emergent intervention for ventilation problems includes
      - (i) Opening the upper and lower airways
      - (ii) Providing assisted ventilation
  - (2) Diffusion
    - (a) Diffusion refers to the process of gas exchange between the air-filled alveoli and the pulmonary capillary bed
    - (b) Gas exchange is driven by simple diffusion - gases from areas of high concentration to areas of low concentration (gas exchange continues until the concentrations are equal)
    - (c) In order for diffusion to occur, the following functions must be intact
      - (i) The alveolar walls must be intact and not thickened
      - (ii) The interstitial space (between the alveoli and capillary wall) must not be enlarged or filled with fluid
      - (iii) The capillary walls must be intact and not thickened

- (d) Emergent intervention for diffusion problems includes
  - (i) Provision of high flow oxygen
  - (ii) Taking measures to reduce inflammation in the interstitial space
- (3) Perfusion
  - (a) Perfusion refers to the process of circulating blood through the pulmonary capillary bed
  - (b) In order for perfusion to occur, the following functions must be intact
    - (i) There must be adequate blood volume (and adequate hemoglobin within the blood)
    - (ii) The pulmonary capillaries must be intact and not occluded
    - (iii) The left heart must be functioning properly to assure a smooth flow of blood through the pulmonary capillary bed
  - (c) Emergent intervention for perfusion problems includes
    - (i) Ensuring adequate circulating volume and hemoglobin levels
    - (ii) Optimizing left heart function as necessary
- c) Rationale behind learning physiology
  - (1) There are many, many different pulmonary diseases
  - (2) Many diseases act in a variety of different ways on a number of body systems
  - (3) Learning the pathophysiology of every respiratory disease is impossible at the paramedic level, and is not a useful exercise because of the dynamic nature of newly developing or identified pulmonary pathologies
  - (4) However, all respiratory problems, old or new, can be categorized as impacting ventilation, diffusion, or perfusion
  - (5) Treatment can be initiated rapidly and effectively once the problem has been identified as ventilation, diffusion, perfusion or a combination
- 2. Anatomy of the pulmonary system
  - a) The upper airway
    - (1) Functions
      - (a) Conduit for air
      - (b) Filtration
      - (c) Warming
      - (d) Humidification

- (e) Protection of lower airway
- (2) Structures
  - (a) Nose
  - (b) Pharynx
  - (c) Larynx
- b) The lower airway
  - (1) Functions
    - (a) Conduit for air
    - (b) Filtration
    - (c) Warming
    - (d) Humidification
    - (e) Removal of foreign particles
  - (2) Structures
    - (a) Trachea
    - (b) Bronchi
    - (c) Bronchioles
    - (d) Cilia
- c) The gas exchange interface
  - (1) Functions
    - (a) Facilitate gas exchange
    - (b) Transfer gases
    - (c) Mechanism and normals
    - (d) Diffusion
    - (e) Venous partial pressures of gases
    - (f) Arterial partial pressures of gases
    - (g) Oxygen saturation
    - (h) Oxyhemoglobin dissociation curve
  - (2) Structures
    - (a) Alveoli
    - (b) Interstitial space
    - (c) Pulmonary capillary bed
- d) The chest wall
  - (1) Functions
    - (a) Ventilation
    - (b) Protection of lungs and airways
    - (c) Mechanism and normals
    - (d) The process of inspiration and expiration
    - (e) Normal respiratory volumes (total lung capacity, tidal volume)

- (2) Structures
  - (a) Diaphragm is the major muscle of respiration
  - (b) Intercostal muscles
  - (c) Accessory muscles
  - (d) Pleural space
- e) The neurologic control of breathing
  - (1) Functions
    - (a) To control ventilation in coordination with physiologic needs
    - (b) Mechanism and normals
    - (c) Driven primarily by the pH of the cerebrospinal fluid - which is influenced by the PaCO<sub>2</sub>
    - (d) Secondary drive is the partial pressure of CO<sub>2</sub> (PaCO<sub>2</sub>)
    - (e) Tertiary drive (typically only utilized in a small number of individuals with severe pulmonary disease) is the PaO<sub>2</sub> as measured by peripheral baroreceptors located in the aortic arch and carotid artery
  - (2) Structures
    - (a) Medulla
    - (b) Phrenic nerve innervate the diaphragm
    - (c) Spinal nerves (thoracic levels) innervate the intercostal
    - (d) Hering-Breuer reflex prevents overinflation

II. 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 paramedic to quickly and effectively pinpoint probable 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
    - (iii) Trauma
  - (b) Phrenic/ spinal nerve dysfunction
    - (i) Trauma
    - (ii) Neuromuscular diseases
- 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) ARDS
        - (b) Asbestosis, environmental lung diseases
        - (c) Near-drowning
        - (d) Post-hypoxia



- (e) Inhalation injuries
    - (4) Capillary bed pathology
      - (a) Severe atherosclerosis
  - 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 (such as silos, enclosed storage spaces etc.)
    - b0 It is critical to assure a safe environment for all EMS personnel before initiating patient contact
    - c0 If necessary, individuals with specialized training and equipment should be utilized to remove the patient from a hazardous environment
  - 2 Initial assessment
    - a0 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
    - b0 Recognition of life threat and the initiation of resuscitation takes priority over detailed assessment
    - c0 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
    - a0 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
- b0 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 paramedic, 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) Inhaled
        - (b) Oral (daily versus during exacerbations only)
      - (iii) Chromolyn sodium
      - (iv) Methylxanthines (theophyllin preparations)
      - (v) Antibiotics
    - (d) Cardiac-related drugs

- (5) History of the present episode
- (6) Exposure/ smoking history
- c0 Physical exam
  - (1) General impression
    - (a) Position
      - (i) Sitting
      - (ii) "Tripod" position
      - (iii) Feet dangling
    - (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 as 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 suggests 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 carcinomas
    - (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
      - (a) Bronchial
      - (b) Bronchovesicular
      - (c) Vesicular
    - (ii) Abnormals
      - (a) Stridor
      - (b) Wheezing
      - (c) Ronchi (low wheezes)
      - (d) Rales (crackles)
      - (e) Pleural friction rub
  - (5) Extremities
    - (a) Peripheral cyanosis
    - (b) Clubbing is indicative of long-standing chronic hypoxemia
    - (c) Carpopedal spasm may be associated with hypocapnia resulting from periods of rapid, deep respiration
- d0 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 CO<sub>2</sub> drops immediately when the tube is displaced from the trachea
    - (b) Quantitative versus qualitative
- C0 Management
  - 1 Airway and ventilation
    - a0 Head-tilt/ chin-lift
    - b0 Jaw thrust without head-tilt
    - c0 Head-tilt/ jaw thrust
    - d0 Oropharyngeal airway
    - e0 Nasopharyngeal airway
    - f0 Nasal cannula
    - g0 Simple oxygen mask

- h0 Nonrebreather mask
- i0 Pharyngeal tracheal double-lumen airway
- j0 Pharyngeal tracheal lumen airway
- k0 Bag-valve-mask
- l0 Bag-valve-mask with PEEP
- m0 CPAP
- n0 Orotracheal intubation
- o0 Nasotracheal intubation
- p0 Suctioning
- q0 Endotracheal tube
- r0 Oxygen powered manually triggered ventilators
- s0 Automatic transport ventilator
- t0 Needle cricothyroidotomy
- u0 Surgical cricothyroidotomy
- 2 Circulation
- 3 Pharmacological
  - a0 Oxygen
  - b0 Sympathomimetic
  - c0 Albuterol
  - d0 Epinephrine
  - e0 Isoetharine
  - f0 Metaproterenol sulfate
  - g0 Racemic epinephrine
  - h0 Terbutaline sulfate
  - i0 Corticosteroid
  - j0 Methylxanthines
  - k0 Theophylline ethylenediamine - aminophylline
  - l0 Antibiotics
  - m0 Mucokinetic drugs
  - n0 Mucolytic drugs
  - o0 Bronchomucotropic drugs
  - p0 Prophylactic asthma drugs
  - q0 Cough suppressants - antitussive agents
  - r0 "Street" drugs
- 4 Non-pharmacological
  - a0 Positioning - sitting up
  - b0 Back blows
- 5 Monitoring and devices used in pulmonary care
  - a0 Pulse oximetry
  - b0 Peak flow
  - c0 Capnometry

- 6 Transport considerations
  - a0 Appropriate mode
  - b0 Appropriate facility

### III Specific illness

- A0 Acute/ adult respiratory distress syndrome
  - 1 Respiratory syndrome characterized by respiratory insufficiency and hypoxia
    - a0 Triggers
      - (1) Aspiration
      - (2) Cardio-pulmonary bypass surgery
      - (3) Gram-negative sepsis
      - (4) Multiple blood transfusions
      - (5) Oxygen toxicity
      - (6) Trauma
      - (7) Pneumonia
      - (8) Respiratory Infection
    - 2 Findings
      - a0 Shortness of breath
      - b0 Rapid breathing
      - c0 Inadequate oxygenation
      - d0 Decreased lung compliance
    - 3 Interventions
      - a0 Airway management
      - b0 Oxygen administration
        - (1) Mechanical ventilation
        - (2) PEEP
      - c0 Improving underlying condition
      - d0 Removing the cause
      - e0 Suction prn
- B0 Obstructive airway diseases
  - 1 A spectrum of diseases which affect a substantial number of individuals worldwide
  - 2 Diseases include asthma and COPD (which includes emphysema and chronic bronchitis)
  - 3 Epidemiology
    - a0 Morbidity/ mortality
      - (1) Overall
      - (2) Asthma - 4-5% of US population
      - (3) 20% of adult males have chronic bronchitis
    - b0 Causative factors
      - (1) Cigarette smoking
      - (2) Exposure to environmental toxins
      - (3) Genetic predisposition
    - c0 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
  - d0 Prevention strategies
    - (1) Smoking prevention, particularly for youth
    - (2) Stop smoking for existing smokers
    - (3) Control of air pollution
    - (4) Provision of smoke-free workplaces and public locations
- 4 Anatomy and physiology review
  - a0 Ventilation disorders
  - b0 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
  - c0 Obstruction may be reversible or irreversible
  - d0 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 Pathophysiology varies slightly by disease
  - a0 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 doesn't respond to therapy
  - b0 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
  - c0 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



- a0 Signs of severe respiratory impairment
  - (1) Altered mentation
  - (2) 1-2 word dyspnea
  - (3) Absent breath sounds
- b0 Chief complaint
  - (1) Dyspnea
  - (2) Cough
  - (3) Nocturnal awakening with dyspnea and wheezing
- c0 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
- d0 Physical findings
  - (1) Wheezing may be present in ALL types of obstructive lung disease
  - (2) Retractions and/ or use of accessory muscles
- e0 Diagnostic testing
  - (1) Pulse oximeter to document degree of hypoxemia and response to therapy
  - (2) Peak flow to establish baseline airflow
- 7 Management
  - a0 Airway and ventilation
    - (1) Intubation as required
    - (2) Assisted ventilation may be necessary
    - (3) High flow oxygen
  - b0 Circulation
    - (1) Intravenous therapy may be necessary to
      - (a) Improve hydration
      - (b) Thin and loosen mucous
    - (2) Pharmacologic
      - (a) Adrenergic stimulants
      - (b) Albuterol
      - (c) Metaproterenol
      - (d) Terbutaline
      - (e) Atropine sulfate
      - (f) Magnesium
      - (g) Methylxanthines
      - (h) Corticosteroid
  - c0 Supportive care
  - d0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
    - (3) Continue monitoring
    - (4) Contact medical direction
  - e0 Psychological support/ communication strategies
- C0 Pneumonia
  - 1 Epidemiology
    - a0 Incidence
      - (1) Fifth leading cause of death in the US
      - (2) Not a single disease, but a group of specific infections
    - b0 Risk factors

- (1) Cigarette smoking
- (2) Alcoholism
- (3) Exposure to cold
- (4) Extremes of age (old or young)
- c0 Anatomy and physiology review
  - (1) Cilia
  - (2) Causes and process of mucous production
- 2 Pathophysiology
  - a0 Ventilation disorder
  - b0 Infection of lung parenchyma
    - (1) Most commonly bacterial
    - (2) May also be viral or fungal
  - c0 May cause alveolar collapse (atelectasis)
  - d0 Localized inflammation/ infection may become systemic, leading to sepsis and septic shock
  - e0 Community acquired versus hospital acquired
- 3 Assessment findings
  - a0 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
    - (7) Egophony
  - b0 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
- 4. Management
  - a) Airway and ventilation
    - (1) Intubation may be required
    - (2) Assisted ventilation as necessary
    - (3) High flow oxygen
  - b) Circulation
    - (1) Intravenous access
    - (2) Administration of IV fluids
    - (3) Improve hydration
    - (4) Thin and mobilize mucous
  - c) Pharmacological
    - (1) Bronchodilators may be required if airway obstruction is severe or if the patient has accompanying obstructive lung disease
    - (2) Antibiotic therapy by prescription
    - (3) Antipyretics
  - d) Non-pharmacological

- (1 Cool if high fever
  - e) Transport considerations
    - (1 Elderly, over 65 years
      - (a Significant co-morbidity
      - (b Inability to take oral medications
      - (c Support complications
      - (d Appropriate facility
    - f) Psychological support/ communication strategies
- D. 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
    - a) Alveoli
    - b) Pulmonary capillaries
    - c) Interstitial space and fluid
    - d) Pulmonary circulation
    - e) Role of surfactant
    - f) Hydrostatic pressure
    - g) Colloid osmotic pressure
    - h) Capillary wall damage
    - i) Left sided heart failure
    - j) Lymphatic drainage
    - k) Pulmonary blood pressures
    - l) Starling's law of the heart
    - m) Hypoalbuminemic states (liver disease)
  - 4. Pathophysiology
    - a) Diffusion disorder
    - b) High pressure (cardiogenic)
      - (1 Left sided heart failure
      - (2 Increase in 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 cardiology 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 climatizing
    - (2 Dyspnea
    - (3 Orthopnea
    - (4 Fatigue
    - (5 Reduced exercise capacity
    - (6 Pulmonary rales, particularly in severe cases
  - c) Diagnostic testing
    - (1 Pulse oximetry
6. Management
- a) High pressure (cardiogenic)
    - (1 Refer to cardiology unit
  - b) High permeability (non-cardiogenic)
    - (1 Airway and ventilation
    - (2 Intubation as necessary
      - (a Assisted ventilation may be required
      - (b High flow oxygen
  - c) Circulation
    - (1 Avoid fluid excess
    - (2 Monitor IV flow rates carefully
  - d) Pharmacological
    - (1 Diuretics may be considered in severe cases, but are not usually appropriate since the etiology is NOT high pressure in the pulmonary capillary bed
    - (2 Corticosteroid to stabilize pulmonary capillary and alveolar walls
  - e) Non-pharmacological
    - (1 Position the patient in an upright position with legs dangling
    - (2 Rapid removal from any environmental toxins
    - (3 Rapid descent in altitude if high altitude pulmonary edema (HAPE) is suspected
  - f) Transport decisions

- (1 Appropriate mode
- (2 Appropriate facility
- g) Psychological support/ communication strategies
- E. Pulmonary thromboembolism
  - 1. Epidemiology
    - a) Incidence
      - (1 Responsible for 50,000 death annually
      - (2 5% of sudden deaths
    - b) Mortality/ morbidity
      - (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 patients
    - d) Prevention strategies
  - 2. Anatomy and physiology review
    - a) Deep veins in lower legs
    - b) Venous system
    - c) Coagulation of blood
    - d) Role of venous stasis
    - e) Venous wall injury
    - f) Venous valves
    - g) Pulmonary vasculature
    - h) Ventilation-perfusion mismatch
  - 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 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)
      - (7) Petechiae on upper thorax and arms
  - 5. Management - prevention has major role in management
    - a) Depends on the size of the embolism
    - b) Airway and ventilation
      - (1) Intubation if necessary
      - (2) Positive pressure ventilation if required
      - (3) High flow oxygen
    - c) Circulation
      - (1) CPR if required
      - (2) IV therapy; hydration based on clinical symptoms
    - d) Pharmacological
      - (1) Thrombolytic therapy may be appropriate if the diagnosis of pulmonary embolus is confirmed, however, this is rare - especially in the out-of-hospital setting
    - e) Non-pharmacological therapy
      - (1) Support body systems
      - (2) Most severe cases will be managed as a cardiac arrest of unknown origin
    - f) Transport considerations
      - (1) Rapid transport
      - (2) Appropriate mode
      - (3) Appropriate facility
    - g) Psychological support/ communication strategies
- F. Neoplasms of the lung
  - 1. Epidemiology
    - a) Incidence
      - (1) 150,000 have cancer
      - (2) Typical age between 55 to 65
      - (3) Morbidity/ mortality
        - (a) Most die within one year
        - (b) 20% local lung involvement
        - (c) 25% spread to lymph
        - (d) 55% distant metastatic cancer
    - b) Prevention
      - (1) Prevent starting smoking in youth

- (2 Smoking cessation in smokers
- (3 Avoidance of environmental hazards, particularly asbestos
- (4 Cancer screening programs
- 2. Anatomy and physiology review
- 3. Pathophysiology
  - a) Significant variety in the cell types, and the growth rates associated with each type
- 4. Assessment findings
  - a) Signs of severe distress
    - (1 Altered mentation
    - (2 1-2 word dyspnea
    - (3 Severe or uncontrollable hemoptysis
  - b) Chief complaints
    - (1 Cough
    - (2 Hemoptysis
    - (3 Dyspnea
    - (4 Hoarseness or voice change
    - (5 Dysphagia
  - c) History
    - (1 Diagnosed history of cancer
  - d) Physical findings
    - (1 Signs and symptoms vary according to location of the tumor
- 5. Management
  - a) Airway and ventilation
    - (1 Intubation if required
    - (2 Assisted ventilation if necessary
    - (3 Oxygen - flow rate based on symptoms and pulse oximetry
    - (4 Supportive care
  - b) Circulation
    - (1 Many patients with diagnosed lung cancer with have an indwelling catheter in place. Local protocols vary regarding whether this catheter may be used for IV infusion in the field.
    - (2 IV infusion may be required to improve hydration or thin/ mobilize sputum
  - c) Pharmacological
    - (1 Out-of-hospital therapy for lung cancer patients is symptomatic, and may include the following
      - (a Bronchodilators
      - (b Corticosteroid
      - (c Continuation of hospital-initiated antibiotics
  - d) Transport considerations
    - (1 End stage patients may have advance directives or DNR
    - (2 Supportive care
  - e) Psychological support/ communication strategies
    - (1 If diagnosed end stage
      - (a Death and dying patient
      - (b Family support
- G. Upper respiratory infection
  - 1. Epidemiology
    - a) Incidence
      - (1 80 million cases in 1975

- b) Morbidity/ mortality
    - (1 Rarely life threatening
    - (2 Often exacerbates underlying pulmonary conditions
    - (3 Often become significant infections in patients with suppressed immune function (such as HIV)
  - c) Risk factors
    - (1 Avoidance of exposure is nearly impossible because of the prevalence of causative agents
    - (2 Severity increases in patients with underlying pulmonary conditions
  - d) Prevention strategies
    - (1 Handwashing and covering the mouth during sneezing and coughing are essential in preventing spread
2. Anatomy and physiology review
- a) Nasopharynx
  - b) Oropharynx
  - c) Paranasal sinus
  - d) Inner ear
  - e) Middle ear
  - f) Outer ear
  - g) Eustachian tubes
  - h) Epiglottis
  - i) Respiratory epithelium
  - j) Lymphatic system
  - k) Secretory antibody IgA
3. Pathophysiology
- a) A variety of bacteria and virus cause URI
  - b) 20-30% are Group A streptococci
  - c) 50% of pharyngitis have no demonstrated bacterial or viral cause
  - d) Most are self-limiting diseases
4. Assessment findings
- a) Chief complaints
    - (1 Sore throat
    - (2 Fever
    - (3 Chills
    - (4 Headache
  - b) Physical findings
    - (1 Cervical adenopathy
    - (2 Erythematous pharynx
    - (3 Positive throat culture
5. Management
- a) Airway and ventilation
    - (1 Typically no intervention required
    - (2 Oxygen administration may be appropriate in patients with underlying pulmonary conditions (administer based on symptoms and pulse oximetry)
  - b) Pharmacological
    - (1 Out-of-hospital care is symptomatic, and based in part on the presence of underlying pulmonary conditions
    - (2 Interventions which may be appropriate include
      - (a Bronchodilators



- (b) Continuation of prescribed antibiotics
      - (c) Corticosteroid
    - c) Non-pharmacological
    - d) Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - e) Psychological support/ communication strategies
      - (1) Collected throat cultures require family notification of results and follow-up care
- H. 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
      - (3) Thin body mass
      - (4) History of COPD (secondary spontaneous pneumothorax)
  - 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 breath sounds
        - (e) Local hyperresonance to percussion
        - (f) Subcutaneous emphysema
  - 3. Management
    - a) Airway and ventilation
      - (1) Intubation as required
      - (2) Assisted ventilation if necessary
      - (3) Oxygen - administration levels based on symptoms and pulse oximetry
    - b) Circulation
      - (1) IV initiation if severe symptoms present
    - c) Pharmacological
      - (1) Not typically necessary; treat symptomatically
    - d) Non-pharmacological
      - (1) Position of comfort/ best ventilation
    - e) Transport considerations
      - (1) Appropriate mode

- (2 Appropriate facility
- f) Psychological support/ communication strategies
- I. Hyperventilation syndrome
  - 1. Multiple causes
    - a) Hypoxia
    - b) High altitude
    - c) Pulmonary disease
    - d) Pulmonary disorders
    - e) Pneumonia
    - f) Interstitial pneumonitis, fibrosis, edema
    - g) Pulmonary emboli, vascular disease
    - h) Bronchial asthma
    - i) Cardiovascular disorders
    - j) Congestive heart failure
    - k) Hypotension
    - l) Metabolic disorders
    - m) Acidosis
    - n) Hepatic failure
    - o) Neurologic disorders
    - p) Psychogenic or anxiety hypertension
    - q) Central nervous system infection, tumors
    - r) Drug-induced
    - s) Salicylate
    - t) Methylxanthine derivatives
    - u) Beta-adrenergic agonists
    - v) Progesterone
    - w) Fever, sepsis
    - x) Pain
    - y) Pregnancy
  - 2. Assessment findings
    - a) Chief complaint
      - (1) Dyspnea
      - (2) Chest pain
      - (3) Other symptoms based on etiology
      - (4) Carpopedal spasm
    - b) Physical findings
      - (1) Rapid breath with high minute volume
      - (2) Varying depending on cause of syndrome
      - (3) Carpopedal spasms
  - 3. Pathophysiology
    - a) Depends on cause of syndrome
  - 4. Management
    - a) Depends on cause of syndrome, discussed elsewhere
      - (1) Airway and ventilation
        - (a) 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
    - b) Circulation
      - (1) Intervention rarely required

- c) Pharmacological
  - (1) Intervention rarely required
- d) Non-pharmacological
  - (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
- e) Transport considerations
  - (1) Appropriate mode
  - (2) Appropriate facility
- f) Psychological support/ communication strategies
  - (1) Depend on cause of hyperventilation

### **UNIT TERMINAL OBJECTIVE**

- 5-2 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement the treatment plan for the patient with cardiovascular disease.

### **COGNITIVE OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-2.1 Describe the incidence, morbidity and mortality of cardiovascular disease. (C-1)
- 5-2.2 Discuss prevention strategies that may reduce the morbidity and mortality of cardiovascular disease. (C-1)
- 5-2.3 Identify the risk factors most predisposing to coronary artery disease. (C-1)
- 5-2.4 Describe the anatomy of the heart, including the position in the thoracic cavity, layers of the heart, chambers of the heart, and location and function of cardiac valves. (C-1)
- 5-2.5 Identify the major structures of the vascular system. (C-1)
- 5-2.6 Identify the factors affecting venous return. (C-1)
- 5-2.7 Identify and define the components of cardiac output. (C-1)
- 5-2.8 Identify phases of the cardiac cycle. (C-1)
- 5-2.9 Identify the arterial blood supply to any given area of the myocardium. (C-1)
- 5-2.10 Compare and contrast the coronary arterial distribution to the major portions of the cardiac conduction system. (C-3)
- 5-2.11 Identify the structure and course of all divisions and subdivisions of the cardiac conduction system. (C-1)
- 5-2.12 Identify and describe how the heart's pacemaking control, rate, and rhythm are determined. (C-2)
- 5-2.13 Explain the physiological basis of conduction delay in the AV node. (C-3)
- 5-2.14 Define the functional properties of cardiac muscle. (C-1)
- 5-2.15 Define the events comprising electrical potential. (C-1)
- 5-2.16 List the most important ions involved in myocardial action potential and their primary function in this process. (C-2)
- 5-2.17 Describe the events involved in the steps from excitation to contraction of cardiac muscle fibers. (C-1)
- 5-2.18 Describe the clinical significance of Starling's law. (C-3)
- 5-2.19 Identify the structures of the autonomic nervous system (ANS). (C-1)
- 5-2.20 Identify the effect of the ANS on heart rate, rhythm and contractility. (C-1)
- 5-2.21 Define and give examples of positive and negative inotropism, chronotropism and dromotropism. (C-2)
- 5-2.22 Discuss the pathophysiology of cardiac disease and injury. (C-1)
- 5-2.23 Identify and describe the details of inspection, auscultation and palpation specific to the cardiovascular system. (C-1)
- 5-2.24 Define pulse deficit, pulsus paradoxus and pulsus alternans. (C-1)
- 5-2.25 Identify the normal characteristics of the point of maximal impulse (PMI). (C-1)
- 5-2.26 Identify and define the heart sounds. (C-1)
- 5-2.27 Relate heart sounds to hemodynamic events in the cardiac cycle. (C-2)
- 5-2.28 Describe the differences between normal and abnormal heart sounds. (C-2)
- 5-2.29 Identify and describe the components of the focused history as it relates to the patient with cardiovascular compromise. (C-1)
- 5-2.30 Explain the purpose of ECG monitoring. (C-1)
- 5-2.31 Describe how ECG wave forms are produced. (C-2)
- 5-2.32 Correlate the electrophysiological and hemodynamic events occurring throughout the entire cardiac cycle with the various ECG wave forms, segments and intervals. (C-2)
- 5-2.33 Identify how heart rates, durations, and amplitudes may be determined from ECG recordings. (C-3)
- 5-2.34 Relate the cardiac surfaces or areas represented by the ECG leads. (C-2)
- 5-2.35 Given an ECG, identify the arrhythmia. (C-3)
- 5-2.36 Identify the limitations to the ECG. (C-1)
- 5-2.37 Differentiate among the primary mechanisms responsible for producing cardiac arrhythmias. (C-1)

- 5-2.38 Describe a systematic approach to the analysis and interpretation of cardiac arrhythmias. (C-2)
- 5-2.39 Describe the arrhythmias originating in the sinus node, the AV junction, the atria, and the ventricles. (C-3)
- 5-2.40 Describe the arrhythmias originating or sustained in the AV junction. (C-3)
- 5-2.41 Describe the abnormalities originating within the bundle branch system. (C-3)
- 5-2.42 Describe the process of differentiating wide QRS complex tachycardias. (C-3)
- 5-2.43 Recognize the pitfalls in the differentiation of wide QRS complex tachycardias. (C-1)
- 5-2.44 Describe the conditions of pulseless electrical activity. (C-3)
- 5-2.45 Describe the phenomena of reentry, aberration and accessory pathways. (C-1)
- 5-2.46 Identify the ECG changes characteristically produced by electrolyte imbalances and specify the clinical implications. (C-2)
- 5-2.47 Identify patient situations where ECG rhythm analysis is indicated. (C-1)
- 5-2.48 Recognize the changes on the ECG that may reflect evidence of myocardial ischemia and injury. (C-1)
- 5-2.49 Recognize the limitations of the ECG in reflecting evidence of myocardial ischemia and injury. (C-1)
- 5-2.50 Correlate abnormal ECG findings with clinical interpretation. (C-2)
- 5-2.51 Identify the major therapeutic objectives in the treatment of the patient with any arrhythmia. (C-1)
- 5-2.52 Identify the major mechanical, pharmacological and electrical therapeutic interventions. (C-3)
- 5-2.53 Based on field impressions, identify the need for rapid intervention for the patient in cardiovascular compromise. (C-3)
- 5-2.54 Describe the incidence, morbidity and mortality associated with myocardial conduction defects. (C-1)
- 5-2.55 Identify the clinical indications for transcutaneous and permanent artificial cardiac pacing. (C-1)
- 5-2.56 Describe the components and the functions of a transcutaneous pacing system. (C-1)
- 5-2.57 Explain what each setting and indicator on a transcutaneous pacing system represents and how the settings may be adjusted. (C-2)
- 5-2.58 Describe the techniques of applying a transcutaneous pacing system. (C-1)
- 5-2.59 Describe the characteristics of an implanted pacemaking system. (C-1)
- 5-2.60 Describe artifacts that may cause confusion when evaluating the ECG of a patient with a pacemaker. (C-2)
- 5-2.61 List the possible complications of pacing. (C-3)
- 5-2.62 List the causes and implications of pacemaker failure. (C-2)
- 5-2.63 Identify additional hazards that interfere with artificial pacemaker function. (C-1)
- 5-2.64 Recognize the complications of artificial pacemakers as evidenced on ECG. (C-2)
- 5-2.65 Describe the epidemiology, morbidity and mortality, and pathophysiology of angina pectoris. (C-1)
- 5-2.66 List and describe the assessment parameters to be evaluated in a patient with angina pectoris. (C-1)
- 5-2.67 Identify what is meant by the OPQRST of chest pain assessment. (C-3)
- 5-2.68 List other clinical conditions that may mimic signs and symptoms of coronary artery disease and angina pectoris. (C-1)
- 5-2.69 Identify the ECG findings in patients with angina pectoris. (C-3)
- 5-2.70 Identify the paramedic responsibilities associated with management of the patient with angina pectoris. (C-2)
- 5-2.71 Based on the pathophysiology and clinical evaluation of the patient with chest pain, list the anticipated clinical problems according to their life-threatening potential. (C-3)
- 5-2.72 Describe the epidemiology, morbidity and mortality of myocardial infarction. (C-1)
- 5-2.73 List the mechanisms by which an MI may be produced by traumatic and non-traumatic events. (C-2)
- 5-2.74 Identify the primary hemodynamic changes produced in myocardial infarction. (C-1)
- 5-2.75 List and describe the assessment parameters to be evaluated in a patient with a suspected myocardial infarction. (C-1)
- 5-2.76 Identify the anticipated clinical presentation of a patient with a suspected acute myocardial infarction. (C-3)
- 5-2.77 Differentiate the characteristics of the pain/ discomfort occurring in angina pectoris and acute myocardial infarction. (C-2)
- 5-2.78 Identify the ECG changes characteristically seen during evolution of an acute myocardial infarction. (C-2)
- 5-2.79 Identify the most common complications of an acute myocardial infarction. (C-3)

- 5-2.80 List the characteristics of a patient eligible for thrombolytic therapy. (C-2)
- 5-2.81 Describe the "window of opportunity" as it pertains to reperfusion of a myocardial injury or infarction. (C-3)
- 5-2.82 Based on the pathophysiology and clinical evaluation of the patient with a suspected acute myocardial infarction, list the anticipated clinical problems according to their life-threatening potential. (C-3)
- 5-2.83 Specify the measures that may be taken to prevent or minimize complications in the patient suspected of myocardial infarction. (C-3)
- 5-2.84 Describe the most commonly used cardiac drugs in terms of therapeutic effect and dosages, routes of administration, side effects and toxic effects. (C-3)
- 5-2.85 Describe the epidemiology, morbidity and mortality of heart failure. (C-1)
- 5-2.86 Define the principle causes and terminology associated with heart failure. (C-1)
- 5-2.87 Identify the factors that may precipitate or aggravate heart failure. (C-3)
- 5-2.88 Describe the physiological effects of heart failure. (C-2)
- 5-2.89 Define the term "acute pulmonary edema" and describe its relationship to left ventricular failure. (C-3)
- 5-2.90 Define preload, afterload and left ventricular end-diastolic pressure and relate each to the pathophysiology of heart failure. (C-3)
- 5-2.91 Differentiate between early and late signs and symptoms of left ventricular failure and those of right ventricular failure. (C-3)
- 5-2.92 Explain the clinical significance of paroxysmal nocturnal dyspnea. (C-1)
- 5-2.93 Explain the clinical significance of edema of the extremities and sacrum. (C-1)
- 5-2.94 List the interventions prescribed for the patient in acute congestive heart failure. (C-2)
- 5-2.95 Describe the most commonly used pharmacological agents in the management of congestive heart failure in terms of therapeutic effect, dosages, routes of administration, side effects and toxic effects. (C-1)
- 5-2.96 Define the term "cardiac tamponade". (C-1)
- 5-2.97 List the mechanisms by which cardiac tamponade may be produced by traumatic and non-traumatic events. (C-2)
- 5-2.98 Identify the limiting factor of pericardial anatomy that determines intrapericardiac pressure. (C-1)
- 5-2.99 Identify the clinical criteria specific to cardiac tamponade. (C-2)
- 5-2.100 Describe how to determine if pulsus paradoxus, pulsus alternans or electrical alternans is present. (C-2)
- 5-2.101 Identify the paramedic responsibilities associated with management of a patient with cardiac tamponade. (C-2)
- 5-2.102 Describe the incidence, morbidity and mortality of hypertensive emergencies. (C-1)
- 5-2.103 Define the term "hypertensive emergency". (C-1)
- 5-2.104 Identify the characteristics of the patient population at risk for developing a hypertensive emergency. (C-1)
- 5-2.105 Explain the essential pathophysiological defect of hypertension in terms of Starling's law of the heart. (C-3)
- 5-2.106 Identify the progressive vascular changes associate with sustained hypertension. (C-1)
- 5-2.107 Describe the clinical features of the patient in a hypertensive emergency. (C-3)
- 5-2.108 Rank the clinical problems of patients in hypertensive emergencies according to their sense of urgency. (C-3)
- 5-2.109 From the priority of clinical problems identified, state the management responsibilities for the patient with a hypertensive emergency. (C-2)
- 5-2.110 Identify the drugs of choice for hypertensive emergencies, rationale for use, clinical precautions and disadvantages of selected antihypertensive agents. (C-3)
- 5-2.111 Correlate abnormal findings with clinical interpretation of the patient with a hypertensive emergency. (C-3)
- 5-2.112 Define the term "cardiogenic shock". (C-1)
- 5-2.113 Describe the major systemic effects of reduced tissue perfusion caused by cardiogenic shock. (C-3)
- 5-2.114 Explain the primary mechanisms by which the heart may compensate for a diminished cardiac output and describe their efficiency in cardiogenic shock. (C-3)
- 5-2.115 Differentiate progressive stages of cardiogenic shock. (C-3)
- 5-2.116 Identify the clinical criteria for cardiogenic shock. (C-1)
- 5-2.117 Describe the characteristics of patients most likely to develop cardiogenic shock. (C-3)

- 5-2.118 Describe the most commonly used pharmacological agents in the management of cardiogenic shock in terms of therapeutic effects, dosages, routes of administration, side effects and toxic effects. (C-2)
- 5-2.119 Correlate abnormal findings with clinical assessment of the patient in cardiogenic shock. (C-3)
- 5-2.120 Identify the paramedic responsibilities associated with management of a patient in cardiogenic shock. (C-2)
- 5-2.121 Define the term "cardiac arrest". (C-1)
- 5-2.122 Identify the characteristics of patient population at risk for developing cardiac arrest from cardiac causes. (C-1)
- 5-2.123 Identify non-cardiac causes of cardiac arrest. (C-1)
- 5-2.124 Describe the arrhythmias seen in cardiac arrest. (C-3)
- 5-2.125 Identify the critical actions necessary in caring for the patient with cardiac arrest. (C-3)
- 5-2.126 Explain how to confirm asystole using the 3-lead ECG. (C-1)
- 5-2.127 Define the terms defibrillation and synchronized cardioversion. (C-1)
- 5-2.128 Specify the methods of supporting the patient with a suspected ineffective implanted defibrillation device. (C-2)
- 5-2.129 Describe the most commonly used pharmacological agents in the managements of cardiac arrest in terms of therapeutic effects. (C-3)
- 5-2.130 Identify resuscitation. (C-1)
- 5-2.131 Identify circumstances and situations where resuscitation efforts would not be initiated. (C-1)
- 5-2.132 Identify and list the inclusion and exclusion criteria for termination of resuscitation efforts. (C-1)
- 5-2.133 Identify communication and documentation protocols with medical direction and law enforcement used for termination of resuscitation efforts. (C-1)
- 5-2.134 Describe the incidence, morbidity and mortality of vascular disorders. (C-1)
- 5-2.135 Describe the pathophysiology of vascular disorders. (C-1)
- 5-2.136 List the traumatic and non-traumatic causes of vascular disorders. (C-1)
- 5-2.137 Define the terms "aneurysm", "claudication" and "phlebitis". (C-1)
- 5-2.138 Identify the peripheral arteries most commonly affected by occlusive disease. (C-1)
- 5-2.139 Identify the major factors involved in the pathophysiology of aortic aneurysm. (C-1)
- 5-2.140 Recognize the usual order of signs and symptoms that develop following peripheral artery occlusion. (C-3)
- 5-2.141 Identify the clinical significance of claudication and presence of arterial bruits in a patient with peripheral vascular disorders. (C-3)
- 5-2.142 Describe the clinical significance of unequal arterial blood pressure readings in the arms. (C-3)
- 5-2.143 Recognize and describe the signs and symptoms of dissecting thoracic or abdominal aneurysm. (C-3)
- 5-2.144 Describe the significant elements of the patient history in a patient with vascular disease. (C-2)
- 5-2.145 Identify the hemodynamic effects of vascular disorders. (C-1)
- 5-2.146 Identify the complications of vascular disorders. (C-1)
- 5-2.147 Identify the Paramedic's responsibilities associated with management of patients with vascular disorders. (C-2)
- 5-2.148 Develop, execute and evaluate a treatment plan based on the field impression for the patient with vascular disorders. (C-3)
- 5-2.149 Differentiate between signs and symptoms of cardiac tamponade, hypertensive emergencies, cardiogenic shock, and cardiac arrest. (C-3)
- 5-2.150 Based on the pathophysiology and clinical evaluation of the patient with chest pain, characterize the clinical problems according to their life-threatening potential. (C-3)
- 5-2.151 Apply knowledge of the epidemiology of cardiovascular disease to develop prevention strategies. (C-3)
- 5-2.152 Integrate pathophysiological principles into the assessment of a patient with cardiovascular disease. (C-3)
- 5-2.153 Apply knowledge of the epidemiology of cardiovascular disease to develop prevention strategies. (C-3)
- 5-2.154 Integrate pathophysiological principles into the assessment of a patient with cardiovascular disease. (C-3)
- 5-2.155 Synthesize patient history, assessment findings and ECG analysis to form a field impression for the patient with cardiovascular disease. (C-3)
- 5-2.156 Integrate pathophysiological principles to the assessment of a patient in need of a pacemaker. (C-1)

- 5-2.157 Synthesize patient history, assessment findings and ECG analysis to form a field impression for the patient in need of a pacemaker. (C-3)
- 5-2.158 Develop, execute, and evaluate a treatment plan based on field impression for the patient in need of a pacemaker. (C-3)
- 5-2.159 Based on the pathophysiology and clinical evaluation of the patient with chest pain, characterize the clinical problems according to their life-threatening potential. (C-3)
- 5-2.160 Integrate pathophysiological principles to the assessment of a patient with chest pain. (C-3)
- 5-2.161 Synthesize patient history, assessment findings and ECG analysis to form a field impression for the patient with angina pectoris. (C-3)
- 5-2.162 Develop, execute and evaluate a treatment plan based on the field impression for the patient with chest pain. (C-3)
- 5-2.163 Integrate pathophysiological principles to the assessment of a patient with a suspected myocardial infarction. (C-3)
- 5-2.164 Synthesize patient history, assessment findings and ECG analysis to form a field impression for the patient with a suspected myocardial infarction. (C-3)
- 5-2.165 Develop, execute and evaluate a treatment plan based on the field impression for the suspected myocardial infarction patient. (C-3)
- 5-2.166 Integrate pathophysiological principles to the assessment of the patient with heart failure. (C-3)
- 5-2.167 Synthesize assessment findings and patient history information to form a field impression of the patient with heart failure. (C-3)
- 5-2.168 Develop, execute, and evaluate a treatment plan based on the field impression for the heart failure patient. (C-3)
- 5-2.169 Integrate pathophysiological principles to the assessment of a patient with cardiac tamponade. (C-3)
- 5-2.170 Synthesize assessment findings and patient history information to form a field impression of the patient with cardiac tamponade. (C-3)
- 5-2.171 Develop, execute and evaluate a treatment plan based on the field impression for the patient with cardiac tamponade. (C-3)
- 5-2.172 Integrate pathophysiological principles to the assessment of the patient with a hypertensive emergency. (C-3)
- 5-2.173 Synthesize assessment findings and patient history information to form a field impression of the patient with a hypertensive emergency. (C-3)
- 5-2.174 Develop, execute and evaluate a treatment plan based on the field impression for the patient with a hypertensive emergency. (C-3)
- 5-2.175 Integrate pathophysiological principles to the assessment of the patient with cardiogenic shock. (C-3)
- 5-2.176 Synthesize assessment findings and patient history information to form a field impression of the patient with cardiogenic shock. (C-3)
- 5-2.177 Develop, execute, and evaluate a treatment plan based on the field impression for the patient with cardiogenic shock. (C-3)
- 5-2.178 Integrate the pathophysiological principles to the assessment of the patient with cardiac arrest. (C-3)
- 5-2.179 Synthesize assessment findings to formulate a rapid intervention for a patient in cardiac arrest. (C-3)
- 5-2.180 Synthesize assessment findings to formulate the termination of resuscitative efforts for a patient in cardiac arrest. (C-3)
- 5-2.181 Integrate pathophysiological principles to the assessment of a patient with vascular disorders. (C-3)
- 5-2.182 Synthesize assessment findings and patient history to form a field impression for the patient with vascular disorders. (C-3)
- 5-2.183 Integrate pathophysiological principles to the assessment and field management of a patient with chest pain. (C-3)

### **AFFECTIVE OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:



- 5-2.184 Value the sense of urgency for initial assessment and intervention in the patient with cardiac compromise. (A-3)
- 5-2.185 Value and defend the sense of urgency necessary to protect the window of opportunity for reperfusion in the patient with suspected myocardial infarction. (A-3)
- 5-2.186 Defend patient situations where ECG rhythm analysis is indicated. (A-3)
- 5-2.187 Value and defend the application of transcutaneous pacing system. (A-3)
- 5-2.188 Value and defend the urgency in identifying pacemaker malfunction. (A-3)
- 5-2.189 Based on the pathophysiology and clinical evaluation of the patient with acute myocardial infarction, characterize the clinical problems according to their life-threatening potential. (A-3)
- 5-2.190 Defend the measures that may be taken to prevent or minimize complications in the patient with a suspected myocardial infarction. (A-3)
- 5-2.191 Defend the urgency based on the severity of the patient's clinical problems in a hypertensive emergency. (A-3)
- 5-2.192 From the priority of clinical problems identified, state the management responsibilities for the patient with a hypertensive emergency. (A-3)
- 5-2.193 Value and defend the urgency in rapid determination of and rapid intervention of patients in cardiac arrest. (A-3)
- 5-2.194 Value and defend the possibility of termination of resuscitative efforts in the out-of-hospital setting. (A-3)
- 5-2.195 Based on the pathophysiology and clinical evaluation of the patient with vascular disorders, characterize the clinical problems according to their life-threatening potential. (A-3)
- 5-2.196 Value and defend the sense of urgency in identifying peripheral vascular occlusion. (A-3)
- 5-2.197 Value and defend the sense of urgency in recognizing signs of aortic aneurysm. (A-3)

### **PSYCHOMOTOR OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-2.198 Demonstrate how to set and adjust the ECG monitor settings to varying patient situations. (P-3)
- 5-2.199 Demonstrate a working knowledge of various ECG lead systems. (P-3)
- 5-2.200 Demonstrate how to record an ECG. (P-2)
- 5-2.201 Perform, document and communicate a cardiovascular assessment. (P-1)
- 5-2.202 Set up and apply a transcutaneous pacing system. (P-3)
- 5-2.203 Given the model of a patient with signs and symptoms of heart failure, position the patient to afford comfort and relief. (P-2 )
- 5-2.204 Demonstrate how to determine if pulsus paradoxus, pulsus alternans or electrical alternans is present. (P-2)
- 5-2.205 Demonstrate satisfactory performance of psychomotor skills of basic and advanced life support techniques according to the current American Heart Association Standards and Guidelines, including: (P-3)
  - a. Cardiopulmonary resuscitation
  - 12. b. Defibrillation
  - 13. c. Synchronized cardioversion
  - 14. d. Transcutaneous pacing
- 5-2.206 Complete a communication patch with medical direction and law enforcement used for termination of resuscitation efforts. (P-1)
- 5-2.207 Demonstrate how to evaluate major peripheral arterial pulses. (P-1)

## DECLARATIVE

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
      - a. Prevalence of cardiac death outside of a hospital
        - (1) Supportive statistics
      - b. Prevalence of prodromal signs and symptoms
        - (1) Supportive statistics
      - c. Increased recognition of need for early reperfusion
    - 2. Morbidity/ mortality
      - a. Reduced with early recognition
      - b. Reduced with early access to EMS system
    - 3. Risk factors
      - a. Age
      - b. Family history
      - c. Hypertension
      - d. Lipids
        - (1) Hypercholesterolemia
      - e. Male sex
      - f. Smoking
      - g. Carbohydrate intolerance
    - 4. Possible contributing risks
      - a. Diet
      - b. Female sex
      - c. Obesity
      - d. Oral contraceptives
      - e. Sedentary living
      - f. Personality type
      - g. Psychosocial tensions
    - 5. Prevention strategies
      - a. Early recognition
      - b. Education
      - c. Alteration of life style
  - B. Cardiovascular anatomy and physiology
    - 1. Anatomy of the heart
    - 2. Location
      - a. Layers
        - (1) Myocardium
        - (2) Endocardium
        - (3) Pericardium
          - (a) Visceral (epicardium)
          - (b) Parietal
      - b. Chambers
        - (1) Atria
        - (2) Ventricles
      - c. Valves
        - (1) Atrioventricular (AV) valves
          - (a) Tricuspid (right)
          - (b) Mitral (left)

- (2) Semilunar valves
      - (a) Pulmonary (right)
      - (b) Aortic (left)
  - d. Papillary muscles
  - e. Chordae tendineae
- 3. Cardiac cycle
  - a. Phases
    - (1) Systole
      - (a) Artrial
      - (b) Ventricular
    - (2) Diastole
      - (a) Artrial
      - (b) Ventricular
  - b. Cardiac output
    - (1) Stroke volume
      - (a) Heart rate
      - (b) Contractility
      - (c) Starling's law
- 4. Vascular system
  - a. Aorta
    - (1) Ascending
    - (2) Thoracic
    - (3) Abdominal
  - b. Arteries
  - c. Arterioles
  - d. Capillaries
  - e. Venule
  - f. Veins
  - g. Vena cava
    - (1) Superior
    - (2) Inferior
  - h. Venous return (preload)
    - (1) Skeletal muscle pump
    - (2) Thoracoabdominal pump
    - (3) Respiratory cycle
    - (4) Gravity
    - (5) IPPB, PEEP, CPAP, BiPAP
  - i. Resistance and capacitance (afterload)
  - j. Pulmonary veins
- 5. Coronary circulation
  - a. Arteries
    - (1) Left coronary artery
      - (a) Anterior descending branch (LAD)
        - i) Distribution to the conduction system
      - (b) Circumflex
        - i) Distribution to the conduction system
    - (2) Right coronary artery
      - (a) Distribution to the conduction system
  - b. Veins
    - (1) Coronary sinus
    - (2) Great cardiac vein

6. Electrophysiology
  - a. Conduction system overview
    - (1) Sinoatrial node or sinus node (SA node)
    - (2) Atrioventricular (AV) junction
      - (a) AV node
      - (b) Bundle of His
    - (3) His-Purkinje system
      - (a) Bundle branches
        - i) Right
        - ii) Left anterior fascicle
        - iii) Left posterior fascicle
    - (4) Characteristics of myocardial cells
      - (a) Automaticity
      - (b) Excitability
      - (c) Conductivity
      - (d) Contractility
  - b0 Electrical potential
    - (1) Action potential
      - (a) Important electrolytes
        - i) Sodium
        - ii) Potassium
        - iii) Calcium
        - iv) Chloride
        - v) Magnesium
    - (2) Excitability
      - (a) Thresholds
      - (b) Depolarization
      - (c) Repolarization
        - i) Relative refractory period
        - ii) Absolute refractory period
    - (3) Neurotransmitters
      - (a) Acetylcholine
        - i) Effects on myocardium
        - ii) Effects on systemic blood vessels
      - (b) Cholinesterase
        - i) Effects on myocardium
        - ii) Effects on systemic blood vessels
  - c0 Autonomic nervous system relationship to cardiovascular system
    - (1) Medulla
    - (2) Carotid sinus and baroreceptor
      - (a) Location
      - (b) Significance
    - (3) Parasympathetic system
    - (4) Sympathetic
      - (a) Alpha - vasoconstrictive effect on systemic blood vessels
      - (b) Beta
        - i) Inotropic effect on myocardium
        - ii) Dromotropic effect on myocardium
        - iii) Chronotropic effect on myocardium
    - (5) Systemic circulation

- 
- II Initial cardiovascular assessment
- A0 Level of responsiveness
  - B0 Airway
    - 1 Patent
    - 2 Debris, blood
  - C0 Breathing
    - 1 Absent
    - 2 Present
      - a0 Rate and depth
        - (1) Effort
        - (2) Breath sounds
          - (a) Characteristics
          - (b) Significance
  - D0 Circulation
    - 1 Pulse
      - a0 Absent
      - b0 Present
        - (1) Rate and quality
          - (a) Pulse deficit
          - (b) Pulsus paradoxus
          - (c) Pulsus alternans
    - 2 Skin
      - a0 Color
      - b0 Temperature
      - c0 Moisture
      - d0 Turgor
      - e0 Mobility
      - f0 Edema
    - 3 Blood pressure
- III Focused history
- A0 H and physical/ SAMPLE format
    - 1 Chief complaint
    - 2 Pain
      - a0 OPQRST
        - (1) Onset/ origin
          - (a) Pertinent past history
          - (b) Time of onset
        - (2) Provocation
          - (a) Exertional
          - (b) Non-exertional
        - (3) Quality
          - (a) Patient's narrative description
            - i For example - sharp, tearing, pressure, heaviness
        - (4) Region/ radiation
          - (a) For example - arms, neck, back
        - (5) Severity
          - (a) "1-10" scale
        - (6) Timing
          - (a) Duration
          - (b) Worsening or improving

- (c) Continuous or intermittent
- (d) At rest or with activity
- 3 Dyspnea
  - a0 Continuous or intermittent
  - b0 Exertional
  - c0 Non-exertional
  - d0 Orthopneic
- 4 Cough
  - a0 Dry
  - b0 Productive
- 5 Related signs and symptoms
  - a0 Level of consciousness
  - b0 Diaphoresis
  - c0 Restlessness, anxiety
  - d0 Feeling of impending doom
  - e0 Nausea/ vomiting
  - f0 Fatigue
  - g0 Palpitations
  - h0 Edema
    - (1) Extremities
    - (2) Sacral
  - i0 Headache
  - j0 Syncope
  - k0 Behavioral change
  - l0 Anguished facial expression
  - m0 Activity limitations
  - n0 Trauma
- 6 Past medical history
  - a0 Coronary artery disease (CAD)
  - b0 Atherosclerotic heart disease
    - (1) Angina
    - (2) Previous MI
    - (3) Hypertension
    - (4) Congestive heart failure (CHF)
  - c0 Valvular disease
  - d0 Aneurysm
  - e0 Pulmonary disease
  - f0 Diabetes
  - g0 Renal disease
  - h0 Vascular disease
  - i0 Inflammatory cardiac disease
  - j0 Previous cardiac surgery
  - k0 Congenital anomalies
  - l0 Current/ past medications
    - (1) Prescribed
      - (a) Compliance
      - (b) Non-compliance
    - (2) Borrowed
    - (3) Over-the-counter
    - (4) Recreational
      - (a) For example - cocaine

- m0 Allergies
- n0 Family history
  - (1) Stroke, heart disease, diabetes, hypertension
  - (2) Age at death
- o0 Known cholesterol levels

IV Detailed physical examination

- A0 Inspection
  - 1 Tracheal position
    - a0 Neck veins
      - (1) Appearance
      - (2) Pressure
      - (3) Clinical significance
    - b0 Thorax
      - (1) Configuration
        - (a) A-P diameter
        - (b) Movement with respirations
      - (2) Clinical significance
    - c0 Epigastrium
      - (a) Pulsation
      - (1) Distention
      - (2) Clinical significance
- B0 Auscultation
  - 1 Neck
    - a0 Normal
    - b0 Abnormal
      - (1) Bruit
  - 2 Breath sounds
    - a0 Depth
    - b0 Equality
    - c0 Adventitious sounds
      - (1) Crackles
      - (2) Wheezes
        - (a) Gurgling
        - (b) Frothing (mouth and nose)
          - i Blood tinged
          - ii Foamy
  - 3 Heart sounds
    - a0 Auscultatory sites
    - b0 Identify S<sub>1</sub>, S<sub>2</sub>
- C0 Palpation
  - 1 Areas of crepitus or tenderness
  - 2 Thorax
  - 3 Epigastrium
    - a0 Pulsation
    - b0 Distention

V Electrocardiographic (ECG) monitoring

- A0 Electrophysiology and wave forms
  - 1 Origination
  - 2 Production

- 
- 3 Relationship of cardiac events to wave forms
  - 4 Intervals
    - a0 Normal
    - b0 Clinical significance
  - 5 Segments
  - B0 Leads and electrodes
    - 1 Electrode
    - 2 Leads
      - a0 Anatomic positions
      - b0 Correct placement
    - 3 Surfaces of heart and lead systems
      - a0 Inferior
      - b0 Left lateral
      - c0 Anterior/ posterior
    - 4 Artifact
  - C0 Standardization
    - 1 Amplitude
    - 2 Height
    - 3 Rate
      - a0 Duration
      - b0 Wave form
      - c0 Segment
      - d0 Complex
      - e0 Interval
  - D0 Wave form analysis
    - 1 Isoelectric
    - 2 Positive
    - 3 Negative
    - 4 Calculation of ECG heart rate
      - a0 Regular rhythm
        - (1) ECG strip method
        - (2) "300" method
      - b0 Irregular rhythm
        - (1) ECG strip method
        - (2) "300" method
  - E0 Lead systems and heart surfaces
    - 1 ECG rhythm analysis
      - a0 Value
      - b0 Limitations
    - 2 Heart surfaces
      - a0 Inferior
      - b0 Left lateral
      - c0 Precordial
    - 3 Acute signs of ischemia, injury and necrosis
      - a0 Rationale
        - (1) Possible early identification of patients with acute myocardial infarction for intervention (thrombolysis or PTCA)
        - (2) The role of out-of-hospital twelve-lead ECG is still unresolved and may not be appropriate in many EMS settings
        - (3) EMS medical directors will make decisions regarding the application and use of the 12-lead ECG in their specific EMS setting



- b0 Advantages/ disadvantages
  - c0 ST segment elevation
    - (1) Height, depth and contour
    - (2) ST (acute changes)
      - (a) Anterior wall
        - i Significant ST elevation in V<sub>1</sub>- V<sub>4</sub> may indicate anterior involvement
      - (b) Inferior wall
        - i Significant ST elevation in II, III and aVF may indicate inferior involvement
    - (3) ST segment depression in eight or more leads
    - (4) ST segment elevation in aVR and V<sub>1</sub>
  - d0 Q waves
    - (1) Depth, duration and significance
      - (a) Greater than 5 mm, greater than .04 seconds
      - (b) May indicate necrosis
      - (c) May indicate extensive transient ischemia
- F0 Cardiac arrhythmias
- 1 Approach to analysis
    - a0 P wave
      - (1) Configuration
      - (2) Duration
      - (3) Atrial rate and rhythm
    - b0 P-R (P-Q) interval
      - (1) Duration
    - c0 QRS complex
      - (1) Configuration
      - (2) Duration
      - (3) Ventricular rate and rhythm
    - d0 S-T segment
      - (1) Contour
      - (2) Elevation
      - (3) Depression
    - e0 Q-T interval
      - (1) Duration
      - (2) Implication of prolongation
    - f0 Relationship of P waves to QRS complexes
      - (1) Consistent
      - (2) Progressive prolongation
      - (3) No relationship
    - g0 T waves
    - h0 U waves
  - 2 Interpretation of the ECG
    - a0 Origin of complex
    - b0 Rate
    - c0 Rhythm
    - d0 Clinical significance
  - 3 Arrhythmia originating in the sinus node
    - a0 Sinus bradycardia
    - b0 Sinus tachycardia

- c0 Sinus arrhythmia
- d0 Sinus arrest
- 4 Arrhythmias originating in the atria
  - a0 Premature atrial complex
  - b0 Atrial (ectopic) tachycardia
  - c0 Re-entrant tachycardia
  - d0 Multifocal atrial tachycardia
  - e0 Atrial flutter
  - f0 Atrial fibrillation
  - g0 Atrial flutter or atrial fibrillation with junctional rhythm
  - h0 Atrial flutter or atrial fibrillation with pre-excitation syndromes
- 5 Arrhythmias originating within the AV junction
  - a0 First degree AV block
  - b0 Second degree AV block
    - (1) Type I
    - (2) Type II/ infranodal
  - c0 Complete AV block (third degree block)
- 6 Arrhythmias sustained or originating in the AV junction
  - a0 AV nodal re-entrant tachycardia
  - b0 AV reciprocating tachycardia
    - (1) Narrow
    - (2) Wide
  - c0 Junctional escape rhythm
  - d0 Premature junctional complex
  - e0 Accelerated junctional rhythm
  - f0 Junctional tachycardia
- 7 Arrhythmias originating in the ventricles
  - a0 Idioventricular rhythm
  - b0 Accelerated idioventricular rhythm
  - c0 Premature ventricular complex (ventricular ectopic)
    - (1) R on T phenomenon
    - (2) Paired/ couplets
    - (3) Multifomed
    - (4) Frequent uniform
  - d0 "Rule of bigeminy" pertaining to precipitating ventricular arrhythmias
  - e0 Ventricular tachycardia
    - (1) Monomorphic
    - (2) Polymorphic (including torsades de pointes)
  - f0 Ventricular fibrillation
  - g0 Ventricular standstill
  - h0 Asystole
- 8 Abnormalities originating within the bundle branch system
  - a0 Incomplete or complete
  - b0 Right bundle branch block
  - c0 Left bundle branch block
- 9 Differentiation of wide QRS complex tachycardia
  - a0 Potential causes
    - (1) Supraventricular tachycardia with bundle branch block
    - (2) Accessory pathways

- b0 Differentiation
    - (1) Physical evaluation
      - (a) Cannon "A" waves
      - (b) Vary intensity of first heart tone
      - (c) Beat to beat changes in blood pressure
    - (2) ECG differences
      - (a) Aberration as a result of premature atrial complex
        - i Identify PAC in previous ST segment or T wave
        - ii Sudden change in rate with bundle branch aberration
        - iii Concealed retrograde conduction
        - iv Right bundle branch refractoriness - may be time dependent
        - v Compare with previous ECG, when available
      - (b) RBBB aberration - V<sub>1</sub> - positive
        - i Biphasic lead I with a broad terminal S-wave
        - ii Triphasic QRS in V<sub>4</sub>
      - (c) LBBB aberration - V<sub>1</sub> - negative
        - i Monophasic notched lead I
        - ii Slurred, notched or RSr' in lead V<sub>4</sub>, V<sub>5</sub>, or V<sub>6</sub>
      - (d) Concordant precordial pattern
        - i Totally negative precordial pattern is diagnostic of ventricular tachycardia
        - ii Totally positive precordial pattern is suggestive of ventricular tachycardia
      - (e) Preexisting BBB prior to onset of tachycardia (by history)
    - (3) Other considerations
      - (a) When in doubt
        - i Cardioversion when hemodynamic state is compromised or changing
        - ii Never use verapamil
        - iii If hemodynamic state is stable - consider lidocaine
      - (b) Pitfalls
        - i Age is not a differential
        - ii Slower rates may present with stable hemodynamic
        - iii Preexisting BBB prior to onset of the tachycardia
      - (c) Regularity
        - i Monomorphic V-tach and SVT are usually very regular and SVT frequently is faster
        - ii Polymorphic V-tach is irregular
- 10 Pulseless electrical activity
    - a0 Electrical mechanical dissociation
    - b0 Mechanical impairments to pulsations/ cardiac output
    - c0 Other possible causes
  - 11 Other ECG phenomena
    - a0 Accessory pathways
    - b0 Preexcitation phenomenon
    - c0 Aberration versus ectopy
  - 12 ECG changes due to electrolyte imbalances
    - a0 Hyperkalemia
    - b0 Hypokalemia
  - 13 ECG changes in hypothermia

- VI Management of the patient with arrhythmias
  - A0 Assessment
    - 1 Symptomatic
    - 2 Hypotensive
    - 3 Hypoperfusion
    - 4 Mechanical
    - 5 Vagal maneuvers - if the heart rate is too fast
    - 6 Stimulation - If heart rate is too slow
    - 7 Precordial thump
    - 8 Cough
  - B. Pharmacological
    - 1. Gases
      - a. Such as oxygen
    - 2. Sympathetic
      - a. Such as epinephrine
    - 3. Anticholinergic
      - a. Such as atropine
    - 4. Antiarrhythmic
      - a. Such as lidocaine
    - 5. Beta blocker
      - a. Selective
        - (1 Such as metoprolol
      - b. Non-selective
        - (1 Such as propranolol
    - 6. Vasopressor
      - a. Such as dopamine
    - 7. Calcium channel blocker
      - a. Such as verapamil
    - 8. Purine nucleoside
      - a. Such as adenosine
    - 9. Platelet aggregate inhibitor
      - a. Such as aspirin
    - 10. Alkalinizing agents
      - a. Such as sodium bicarbonate
    - 11. Cardiac glycoside
      - a. Such as digitalis
    - 12. Narcotic/ analgesic
      - a. Such as morphine
    - 13. Diuretic
      - a. Such as furosemide
    - 14. Nitrate
      - a. Such as nitroglycerin
    - 15. Antihypertensive
      - a. Such as sodium nitroprusside
  - C. Electrical
    - 1. Purpose
    - 2. Methods
      - a. Synchronized cardioversion
      - b. Defibrillation

- c. Cardiac pacing
  - (1 Implanted pacemaker functions
    - (a Characteristics
    - (b Pacemaker artifact
    - (c ECG tracing of capture
    - (d Failure to sense
      - i) ECG indications
      - ii) Clinical significance
    - (e Failure to capture
      - i) ECG indications
      - ii) Clinical significance
    - (f Failure to pace
      - i) ECG indications
      - ii) Clinical significance
    - (g Pacer-induced tachycardia
      - i) ECG findings
      - ii) Clinical significance
      - iii) Treatment
  - (2 Transcutaneous pacing
    - (a Criteria for use
    - (b Bradycardia
      - i) Patient is hypotensive/ hypoperfusing
      - ii) No change with pharmacologic intervention
    - (c Second degree AV block
      - i) Patient is hypotensive/ hypoperfusing
      - ii) No change with pharmacologic intervention
    - (d Complete AV block
      - i) Patient is hypotensive/ hypoperfusing
      - ii) No change with pharmacologic intervention
    - (e Asystole
    - (f Overdrive
      - i) Deter occurrence of recurrent tachycardia
- d. Set-up
  - (1 Placement of electrodes
  - (2 Rate and milliampere (mA) settings
  - (3 Pacer artifact
  - (4 Capture
  - (5 Failure to sense
    - (a Causes
    - (b Implications
    - (c Interventions
  - (6 Failure to capture
    - (a Causes
    - (b Implications
    - (c Interventions
  - (7 Failure to pace
    - (a Causes
    - (b Implications
    - (c Interventions
  - (8 Hazards

- (9 Complications
  - (a Interventions
- D. Transport
  - 1. Indications for rapid transport
  - 2. Indications for no transport required
  - 3. Indications for referral
- E. Support and communications strategies
  - 1. Explanation for patient, family, significant others
  - 2. Communications and transfer of data to the physician
- VII. Angina pectoris
  - A. Epidemiology
    - 1. Precipitating causes
      - a. Atherosclerosis
      - b. Vasospastic (Prinzmetal's)
  - B. Morbidity/ mortality
    - 1. Not a self-limiting disease
    - 2. Chest pain may dissipate, but myocardial ischemia and injury can continue
    - 3. A single anginal episode may be a precursor to myocardial infarction
    - 4. May not be cardiac in origin
    - 5. Must be diagnosed by a physician
    - 6. Related terminology
      - a. Defined as a brief discomfort, has predictable characteristics and is relieved promptly - no change in this pattern
      - b. Stable
        - (1 Occurs at a relative fixed frequency
        - (2 Usually relieved by rest and/ or medication
      - c. Unstable
        - (1 Occurs without fixed frequency
        - (2 May or may not be relieved by rest and/ or medication
      - d. Initial - first episode
      - e. Progressive - accelerating in frequency and duration
      - f. Preinfarction angina
        - (1 Pain at rest
        - (2 Sitting or lying down
    - 7. Differential diagnoses
      - a. Cholecystitis
      - b. Acute viral pericarditis or any other inflammatory cardiac disease
      - c. Aneurysm
      - d. Hiatal hernia
      - e. Esophageal disease
      - f. Gastric reflux
      - g. Pulmonary embolism
      - h. Peptic ulcer disease
      - i. Pancreatitis
      - j. Chest wall syndrome
      - k. Costochondritis
      - l. Acromioclavicular disease
      - m. Pleural irritation
      - n. Respiratory infections
      - o. Aortic dissection

- p. Pneumothorax
  - q. Dyspepsia
  - r. Herpes zoster
  - s. Chest wall tumors
  - t. Chest wall trauma
- C. Initial assessment findings
- 1. Airway/ breathing
    - a. Labored breathing may or may not be present
  - 2. Circulation
    - a. Peripheral pulses
      - (1 Quality
      - (2 Rhythm
    - b. Changes in skin
      - (1 Color
      - (2 Temperature
      - (3 Moisture
- D. Focused history
- 1. Chief complaint
    - a. Typical - sudden onset of discomfort, usually of brief duration, lasting three to five minutes, maybe five to 15 minutes; never 30 minutes to two hours
    - b. Typical - usually relieved by rest and/ or medication
    - c. Epigastric pain or discomfort
    - d. Atypical
  - 2. Denial
  - 3. Contributing history
    - a. Initial recognized event
    - b. Recurrent event
    - c. Increasing frequency and/ or duration of event
- E. Detailed physical exam
- 1. Airway
  - 2. Breathing
    - a. May or may not be labored
      - (1 Sounds
        - (a May be clear to auscultation
        - (b May be congested in the bases
  - 3. Circulation
    - a. Alterations in heart rate and rhythm may occur
    - b. Peripheral pulses are usually not affected
    - c. Blood pressure may be elevated during the episode and normalize afterwards
    - d. ECG Devices
      - (1 Monitor
      - (2 Transmission
      - (3 Documentation
      - (4 Computerized pattern identification
        - (a Pitfalls
        - (b Common errors
    - e. Findings
      - (1 ST segment changes are often not specific
      - (2 Arrhythmias and ectopy may not be present
- F. Management
- 1. Position of comfort

2. Pharmacological
    - a. Gases
    - b. Nitrates
    - c. Analgesics
    - d. Possible antiarrhythmic
    - e. Possible antihypertensives
  3. ECG
    - a. Whenever possible, and scene time is not delayed, record and transmit 3-lead and/ or 12-lead ECG during pain, since ECG may be normal during the pain-free period
    - b. Measure, record and communicate ST segment changes
  4. Transport
    - a. Indications for rapid transport
      - (1 Sense of urgency for reperfusion
      - (2 No relief with medications
      - (3 Hypotension/ hypoperfusion
      - (4 Significant changes in ECG
    - b. No transport
      - (1 Patient refusal
      - (2 Referral
- G. Support and communications strategies
1. Explanation for patient, family, significant others
  2. Communications and transfer of data to the physician

VIII. Myocardial infarction

- A. Epidemiology
1. Precipitating causes (as with angina)
    - a. Atherosclerosis
    - b. Persistent angina
    - c. Occlusion
    - d. Non-traumatic
      - (1 Recreational drugs
    - e. Trauma
- B. Morbidity/ mortality
1. Sudden death
  2. Extensive myocardial damage
  3. May result in ventricular fibrillation
    - a. Prevention strategies
      - (1 Relieve pain
      - (2 Effect reperfusion
- C. Initial assessment findings
1. Airway/ breathing
    - a. Labored breathing may or may not be present
  2. Circulation
    - a. Peripheral pulses
      - (1 Quality
      - (2 Rhythm
    - b. Changes in skin
      - (1 Color
      - (2 Temperature
      - (3 Moisture



- D. Focused history
  - 1. Chief complaint
    - a. Typical onset of discomfort, usually of long duration, over 30 minutes
    - b. Typically unrelieved by rest and/ or nitroglycerin preparation
    - c. Epigastric pain or discomfort
    - d. Atypical
  - 2. Contributing history
    - a. First time
    - b. Recurrent
    - c. Increasing frequency and/ or duration
  - 3. Denial
- E. Detailed physical exam
  - 1. Airway
  - 2. Breath sounds
    - a. May be clear to auscultation
    - b. Congestion in bases may be present
  - 3. Circulation
    - a. Skin
      - (1 Pallor during the episode
      - (2 Temperature may vary
      - (3 Diaphoresis is usually present
    - b. Alterations in heart rate and rhythm may occur
    - c. Peripheral pulses are usually not affected
    - d. Blood pressure may be elevated or lowered
    - e. ECG findings
      - (1 ST segment elevation
        - (a Height, depth and contour
        - (b ST changes
        - (c ST segment depression in reciprocal leads
      - (2 Q waves
        - (a Depth, duration and significance
          - i) Greater than 5 mm, greater than .04 seconds
          - ii) May indicate necrosis
          - iii) May indicate extensive transient ischemia
      - (3 ECG Rhythm analysis
        - (a Criteria for patient selection for rapid transport and reperfusion
        - (b Value
        - (c Signs of acute ischemia, injury, and necrosis
        - (d Criteria for patient selection for rapid transport and reperfusion
          - i) Time of onset of pain
          - ii) Location of ischemia and infarction
          - iii) ST segment elevation
      - (4 Cardiac arrhythmias
        - (a Sinus tachycardia with or without ectopy
        - (b Narrow or wide QRS complex tachycardia
        - (c Sinus bradycardia
        - (d Heart blocks
        - (e Ventricular fibrillation
        - (f Pulseless electrical activity (PEA)
        - (g Asystole (confirmed in a second lead)

- F. Management
    - 1. Position of comfort
    - 2. Pharmacological
      - a. Gases
      - b. Nitrates
      - c. Platelet aggregate inhibitor
      - d. Analgesia
      - e. Increase or decrease heart rate
      - f. Possible antiarrhythmic
      - g. Possible antihypertensives
    - 3. Electrical
      - a. Constant ECG monitoring
      - b. Defibrillation/ synchronized cardioversion
      - c. Transcutaneous pacing
    - 4. Transport
      - a. Criteria for rapid transport
        - (1 No relief with medications
          - (a Hypotension/ hypoperfusion
          - (b Significant changes in ECG
            - i) Ectopy
            - ii) Arrhythmias
      - b. ECG criteria for rapid transport and reperfusion
        - (1 Time of onset of pain
        - (2 ECG rhythm abnormalities
      - c. Indications for “no transport”
        - (1 Refusal
        - (2 No other indications for no-transport
    - 5. Support and communications strategies
      - (1 Explanation for patient, family, significant others
      - (2 Communications and transfer of data to the physician
- IX. Heart failure
  - A. Epidemiology
    - 1. Precipitating causes
      - a. Left sided failure
      - b. Right sided failure
      - b. Myocardial infarction
      - c. Pulmonary embolism
      - d. Hypertension
      - e. Cardiomegaly
      - f. High output failure
      - g. Low output failure
    - 2. Related terminology
      - a. Preload
      - b. Afterload
      - c. Congestive heart failure
        - (1 Loss of contractile ability which results in fluid overload
      - d. Chronic versus acute
        - (1 First time event
        - (2 Multiple events

- B. Morbidity/ mortality
  - 1. Pulmonary edema
  - 2. Respiratory failure
  - 3. Death
- C. Initial assessment
  - 1. Airway/ breathing
    - a. Labored breathing may or may not be present
  - 2. Circulation
    - a. Peripheral pulses
      - (1 Quality
      - (2 Rhythm
    - b. Changes in skin
      - (1 Color
      - (2 Temperature
      - (3 Moisture
- D. Focused history
  - 1. Chief complaint
    - a. Progressive or acute SOB
    - b. Progressive accumulation of edema
    - c. Weight gain over short period of time
    - d. Episodes of paroxysmal nocturnal dyspnea
    - e. Medication history
      - (1 Prescribed
        - (a Compliance
        - (b Non-compliance
      - (2 Borrowed
      - (3 Over-the-counter
    - f. Home oxygen use
- E. Detailed physical exam
  - 1. Level of consciousness
    - a. Unconscious
    - b. Altered levels of consciousness
  - 2. Airway/ breathing
    - a. Dyspnea
    - b. Productive cough
    - c. Labored breathing
      - (1 Most common, often with activity
      - (2 Paroxysmal nocturnal dyspnea (PND)
      - (3 Tripod position
      - (4 Adventitious sounds
      - (5 Retraction
  - 3. Circulation
    - a. Heart rate/ rhythm
      - (1 Any tachycardia with ectopy
      - (2 Any bradycardia with ectopy
      - (3 Atrial arrhythmias
    - b. Changes in skin
      - (1 Color
      - (2 Temperature
      - (3 Moisture

- c. Peripheral pulses
    - (1) Quality
    - (2) Rhythm
  - d. Edema
    - (1) Pitting versus non-pitting
    - (2) Extremities
      - (a) Localized in ankles
      - (b) To the midcalf
      - (c) To the knees
      - (d) Obliteration of pulses
    - (3) Ascites
      - (a) Engorged mass(es) in upper abdominal quadrants
    - (4) Sacral
- F. Complications
- 1. Pulmonary edema
    - a. Signs and symptoms
      - (1) Tachypnea
      - (2) Wheezing
      - (3) Rales at both bases
      - (4) Elevated jugular venous pressure
      - (5) Pulsus paradoxus
      - (6) Rapid "thready" pulse
      - (7) Pulsus alternans
      - (8) Abnormalities of apical pulse
        - (a) Due to displaced cardiac apex
        - (b) Abnormal bulges
      - (9) Cyanosis in advanced stages
      - (10) Frothy sputum
- G. Management
- 1. Position of comfort
  - 2. Pharmacological
    - a. Gases
    - b. Afterload reduction
    - c. Analgesia
    - d. Diuresis
    - e. Other
  - 3. Transport
    - a. Refusal
    - b. No other indications for no-transport
- H. Support and communications strategies
- 1. Explanation for patient, family, significant others
  - 2. Communications and transfer of data to the physician
- X. Cardiac tamponade
- A. Pathophysiology
    - 1. Defined as impaired diastolic filling of the heart caused by increased intrapericardiac pressure
    - 2. Precipitating causes
      - a. Gradual onset with neoplasm or infection
      - b. Acute onset with infarction
      - c. Trauma

- (1) Can occur with CPR
      - (2) Penetrating injury
      - (3) Non-penetrating injury
    - d. Secondary to renal disease
    - e. Hypothyroidism
- B. Morbidity/ mortality
  - 1. Death if not relieved
- C. Initial assessment
  - 1. Airway/ breathing
    - a. Labored breathing may or may not be present
  - 2. Circulation
    - a. Peripheral pulses
      - (1) Quality
      - (2) Rhythm
    - b. Changes in skin
      - (1) Color
      - (2) Temperature
      - (3) Moisture
- D. Focused history (as in precipitating causes)
- E. Detailed physical examination
  - 1. Airway/ breathing
    - a. Dyspnea
    - b. Orthopnea
  - 2. Circulation
    - a. Pulse rate and rhythm
    - b. Chest pain
    - c. Tachycardia
    - d. Ectopy
    - e. Elevated venous pressures (early sign)
    - f. Decreased systolic pressure (early sign)
    - g. Narrowing pulse pressure (early sign)
    - h. Pulsus paradoxus
    - i. Heart sounds normal early on, progressively faint or muffled
    - j. ECG changes
      - (1) Low voltage QRS and T waves
      - (2) ST elevation or non-specific T wave changes
      - (3) Electrical alternans of PQRST
      - (4) Usually inconclusive - should not be used as a diagnostic tool
- F. Management
  - 1. Airway management and ventilation
  - 2. Circulation
  - 3. Pharmacological
  - 4. Non-pharmacological
  - 5. Rapid transport for pericardiocentesis
- G. Support and communications strategies
  - 1. Explanation for patient, family, significant others
  - 2. Communications and transfer of data to the physician

- XI. Hypertensive emergencies
  - A. Epidemiology
    - 1. Precipitating causes
      - a. History of hypertension
      - b. Non-compliance with medication or any other treatment
      - c. Toxemia of pregnancy
  - B. Morbidity/ mortality
    - a. Hypertensive encephalopathy
    - b. Stroke
  - C. Initial assessment
    - 1. Airway/ breathing
      - a. Labored breathing may or may not be present
    - 2. Circulation
      - a. Peripheral pulses
        - (1) Quality
        - (2) Rhythm
      - b. Changes in skin
        - (1) Color
        - (2) Temperature
        - (3) Moisture
  - D. Focused history
    - 1. Chief complaint
      - a. As in precipitating causes above
    - 2. Medication history
      - a. Prescribed
        - (1) Compliance
        - (2) Non-compliance with medication or treatment
      - b. Borrowed
      - c. Over-the-counter
    - 3. Home oxygen use
  - E. Detailed physical examination
    - 1. Airway
    - 2. Breath sounds
    - 3. Circulation
      - a. Pulse
      - b. Vital signs
        - (1) Blood pressure
          - (a) Systolic greater than 160 mmHg
          - (b) Diastolic greater than 94 mmHg
    - 4. Diagnostic signs/ symptoms
      - a. General appearance
      - b. Level of consciousness
        - (1) Unconscious
        - (2) Altered level of consciousness
        - (3) Responsive
      - c. Skin color
        - (1) Can be pallor, flushed, or normal
      - d. Skin hydration
        - (1) Can be dry or moist
      - e. Skin temperature
        - (1) Can be warm or cool

- f. Peripheral pulses
    - (1) Can be strong
  - g. Edema
    - (1) Pitting versus non-pitting
  - h. Paroxysmal nocturnal dyspnea
  - i. Labored breathing (SOB)
  - j. Orthopnea
  - k. Vertigo
  - l. Epistaxis
  - m. Tinnitus
  - n. Changes in visual acuity
  - o. Nausea/ vomiting
  - p. Seizures
  - q. Lateralizing signs
  - r. ECG findings
- F. Management
- 1. Non-pharmacologic
    - a. Position of comfort
    - b. Airway and ventilation
  - 2. Pharmacological
    - a. Gases
    - b. Other
  - 3. Rapid transport
    - a. Refusal
    - b. No other indications for no transport
- G. Support and communications strategies
- 1. Explanation for patient, family, significant others
  - 2. Communications and transfer of data to the physician
- XII. Cardiogenic shock
- A. Pathophysiology
- 1. Precipitating causes
    - a. Myocardial infarction
      - (1) Can be acute or progressive
    - b. Age
      - (1) Progressive
    - c. Trauma
- B. Initial assessment
- 1. Airway/ breathing
    - a. Labored breathing may or may not be present
  - 2. Circulation
    - a. Peripheral pulses
      - (1) Quality
      - (2) Rhythm
    - b. Changes in skin
      - (1) Color
      - (2) Temperature
      - (3) Moisture
- C. Focused history
- 1. Chief complaint
    - a. As in precipitating causes above

- 2. Medication history
  - a. Prescribed
    - (1) Compliance
    - (2) Non-compliance
  - b. Borrowed
  - c. Over-the-counter
- D. Detailed physical exam
  - 1. Critical findings
    - a. Unconscious
    - b. Altered levels of consciousness
    - c. Airway
      - (1) Dyspnea
      - (2) Productive cough
      - (3) Labored breathing
        - (a) Paroxysmal nocturnal dyspnea (PND)
        - (b) Tripod position
        - (c) Adventitious sounds
        - (d) Retraction
    - d. ECG rhythm analysis
      - (1) Any tachycardia
      - (2) Atrial arrhythmias
      - (3) Ectopics
    - e. Changes in skin
      - (1) Color
      - (2) Temperature
      - (3) Moisture
    - f. Peripheral pulses
      - (1) Quality
      - (2) Rhythm
    - g. Edema
      - (1) Pitting versus non-pitting
      - (2) Extremities
        - (a) Obliteration of pulses
      - (3) Sacral
- E. Management
  - 1. Position of comfort
    - a. May prefer sitting upright with legs in dependent position
  - 2. Pharmacological
    - a. Gases
    - b. Vasopressor
    - c. Analgesia
    - d. Diuretics
    - e. Glycoside
    - f. Sympathetic agonist
    - g. Alkalinizing agent
    - h. Other
- F. Transport
  - 1. Refusal
  - 2. No other indications for no transport



- G. Support and communications strategies
  - 1. Explanation for patient, family, significant others
  - 2. Communications and transfer of data to the physician
  
- XIII. Cardiac arrest
  - A. Pathophysiology
    - 1. Precipitating causes
      - a. Trauma
      - b. Medical conditions (for example)
        - (1) End stage renal disease
        - (2) Hyperkalemia with renal disease
  - B. Initial assessment
    - 1. Critical findings
      - a. Unresponsive
      - b. Apneic
      - c. Heart rate/ rhythm
        - (1) Ventricular fibrillation
        - (2) Ventricular tachycardia
        - (3) Asystole
        - (4) PEA
      - d. Peripheral pulses
        - (1) None
  - C. Focused history
    - 1. Witnessed event
    - 2. Witnessed by EMS personnel
    - 3. Bystander cardiopulmonary resuscitation (CPR)
    - 4. Time from discovery to activation of CPR
    - 5. Time from discovery to activation of EMS
    - 6. Past medical history
  - D. Management
    - 1. Related terminology
      - a. Resuscitation - to provide efforts to return spontaneous pulse and breathing to the patient in full cardiac arrest
      - b. Survival - patient is resuscitated and survives to hospital discharge
      - c. Return of spontaneous circulation (ROSC) - patient is resuscitated to the point of having pulse without CPR; may or may not have return of spontaneous respirations; patient may or may not go on to survive
    - 2. Indications for NOT initiating resuscitative techniques
      - a. Signs of obvious death
        - (1) For example - rigor; fixed lividity; decapitation
      - b. Local protocol
        - (1) For example - out-of-hospital advance directives
    - 3. Advanced airway management and ventilation
    - 4. Circulation
      - a. CPR in conjunction with defibrillation
      - b. IV therapy
      - c. Defibrillation
      - d. Pharmacological
        - (1) Gases (oxygen)
        - (2) Sympathetic
        - (3) Anticholinergic

- (4) Antiarrhythmic
- (5) Vasopressor
- (6) Alkalinizing agents
- (7) Parasympatholytic
- 5. Rapid transport
- 6. Support and communications strategies
  - a. Explanation for patient, family, significant others
  - b. Communications and transfer of data to the physician
- E. Termination of resuscitation
  - 1. Inclusion criteria (for example)
    - a. 18 years old or older
    - b. Arrest is presumed cardiac in origin and not associated with a condition potentially responsive to hospital treatment (for example - hypothermia, drug overdose, toxicologic exposure, etc.)
    - c. Endotracheal intubation has been successfully accomplished and maintained
    - d. Standard advanced cardiac life support (ACLS) measures have been applied throughout the resuscitative effort
    - e. On-scene ALS resuscitation efforts have been sustained for 25 minutes or the patient remains in asystole through four rounds of appropriate ALS drugs
    - f. Patient has a cardiac rhythm of asystole or agonal rhythm at the time the decision to terminate is made and this rhythm persists until the arrest is actually terminated
    - g. Victims of blunt trauma in arrest whose presenting rhythm is asystole, or who develop asystole while on scene
  - 2. Exclusion criteria - for example
    - a. Under the age of 18 years
    - b. Etiology for which specific in-hospital treatment may be beneficial
    - c. Persistent or recurrent ventricular tachycardia or fibrillation
    - d. Transient return of pulse
    - e. Signs of neurological viability
    - f. Arrest was witnessed by EMS personnel
    - g. Family or responsible party opposed to termination
  - 3. Criteria NOT to be considered as inclusionary or exclusionary
    - a. Patient age - for example, geriatric
    - b. Time of collapse prior to EMS arrival
    - c. Presence of a non-official do-not-resuscitate (DNR) order
    - d. "Quality of life" valuations
  - 4. Procedures (according to local protocol)
    - a. Direct communication with on-line medical direction
      - (1) Medical condition of the patient
      - (2) Known etiologic factors
      - (3) Therapy rendered
      - (4) Family present and apprised of the situation
      - (5) Communicate any resistance or uncertainty on the part of the family
      - (6) Maintain continuous documentation to include the ECG
      - (7) Mandatory review after the event
        - (a) Grief support (according to local protocol)
          - i) EMS assigned personnel
          - ii) Community agency referral
        - (b) Law enforcement (according to local protocol)

- i) On-scene determination if the event/ patient requires assignment of the patient to the medical examiner
- ii) On-scene law enforcement communicates with attending physician for the death certificate
- iii) If there is any suspicion about the nature of the death, or if the physician refuses or hesitates to sign the death certificate
- iv) No attending physician is identified (the patient will be assigned to the medical examiner)

XIV. Vascular disorders

A. Epidemiology

1. Trauma

2. Non-traumatic

a. Precipitating causes

(1) Atherosclerosis

(2) Aneurysm

(a) Atherosclerotic

(b) Dissecting

i) Cystic medial necrosis

(c) Infections

(d) Congenital

(3) Marfan's syndrome

(4) Inflammation

(a) Arterial

(b) Peripheral arterial atherosclerotic disease

(5) Occlusive disease

(a) Trauma

(b) Thrombosis

(c) Tumor

(d) Embolus

(e) Idiopathic

(6) Venous thrombosis

(a) Phlebitis

(b) Varicose veins

B. Morbidity/ mortality

1. Pulmonary occlusion

2. Cerebral occlusion

3. Mesenteric occlusion

4. Hypoperfusion state

5. Death

C. Initial assessment findings

1. Airway/ breathing

a. Usually not affected

2. Circulation (distal to or over the affected area)

a. Pain

b. Pallor

c. Pulselessness

d. Paralysis

e. Paresthesia

3. Skin

- a. Pallor or mottled distal to or over the affected area
- b. Skin temperature may vary
- D. Focused history
  - 1. Chief complaint
    - a. Sudden or gradual onset of discomfort
    - b. May be localized
    - c. Pain
      - (1) Chest, abdominal or involved extremity
        - (a) Sudden or gradual
        - (b) Radiating or localized
        - (c) Claudication
      - (2) Relief with rest or not
  - 2. Contributing history
    - a. Initial recognized event
    - b. Recurrent event
    - c. Increasing frequency and/ or duration of event
- E. Detailed physical exam
  - 1. Airway
  - 2. Breath sounds
    - a. May be clear to auscultation
  - 3. Circulation
    - a. Alterations in heart rate and rhythm may occur
    - b. Peripheral pulses absent or diminished over the affected extremity
    - c. Blood pressure
      - (1) Unequal BP readings in each arm
        - (a) May indicate high thoracic aneurysm
    - d. Bruit over affected vessel(s)
    - e. Skin
      - (1) May be cool reflecting diminished circulation to the affected area or extremity
      - (2) May be moist or dry reflecting diminished circulation to the affected area or extremity
    - f. ECG findings may be non contributory
      - (1) Arrhythmias and ectopy may not be present
  - 4. Management
    - a. Position of comfort
    - b. Pharmacological
      - (1) Gases
      - (2) Analgesics
    - c. Transport
      - (1) Indications for rapid transport
        - (a) No relief with medications
        - (b) Hypotension/ hypoperfusion
      - (2) No transport
        - (a) Refusal
        - (b) Relief and refusal
    - d. Support and communications strategies
      - (1) Explanation for patient, family, significant others
      - (2) Communications and transfer of data to the physician

- XV. Integration
  - A. Apply pathophysiological principles to the assessment of a patient with cardiovascular disease
  - B. Formulation of field impression; decisions based on
    - 1. Initial assessment
    - 2. Focused history
    - 3. Detailed physical examination
  - C. Develop and execute a patient management plan based on field impression
    - 1. Initial management
      - a. Airway support
      - b. Ventilation support
      - c. Circulation support
      - d. Non-pharmacological
      - e. Pharmacological
      - f. Electrical
    - 2. On-going assessment
    - 3. Transport criteria
      - a. Appropriate mode
      - b. Appropriate facility
    - 4. Non-transport criteria
    - 5. Advocacy
    - 6. Communications
    - 7. Prevention
    - 8. Documentation
    - 9. Quality assurance

#### REFERENCES

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### **UNIT TERMINAL OBJECTIVE**

- 5-3 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement the treatment plan for the patient with a neurological problem.

### **COGNITIVE OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-3.1 Describe the incidence, morbidity and mortality of neurological emergencies. (C-1)
- 5-3.2 Identify the risk factors most predisposing to the nervous system. (C-1)
- 5-3.3 Discuss the anatomy and physiology of the organs and structures related to nervous system. (C-1)
- 5-3.4 Discuss the pathophysiology of non-traumatic neurologic emergencies. (C-1)
- 5-3.5 Discuss the assessment findings associated with non-traumatic neurologic emergencies. (C-1)
- 5-3.6 Identify the need for rapid intervention and the transport of the patient with non-traumatic emergencies. (C-1)
- 5-3.7 Discuss the management of non-traumatic neurological emergencies. (C-1)
- 5-3.8 Discuss the pathophysiology of coma and altered mental status. (C-1)
- 5-3.9 Discuss the assessment findings associated with coma and altered mental status. (C-1)
- 5-3.10 Discuss the management/ treatment plan of coma and altered mental status. (C-1)
- 5-3.11 Describe the epidemiology, including the morbidity/ mortality and prevention strategies, for seizures. (C-1)
- 5-3.12 Discuss the pathophysiology of seizures. (C-1)
- 5-3.13 Discuss the assessment findings associated with seizures. (C-1)
- 5-3.14 Define seizure. (C-1)
- 5-3.15 Describe and differentiate the major types of seizures. (C-3)
- 5-3.16 List the most common causes of seizures. (C-1)
- 5-3.17 Describe the phases of a generalized seizure. (C-1)
- 5-3.18 Discuss the pathophysiology of syncope. (C-1)
- 5-3.19 Discuss the assessment findings associated with syncope. (C-1)
- 5-3.20 Discuss the management/ treatment plan of syncope. (C-1)
- 5-3.21 Discuss the pathophysiology of headache. (C-1)
- 5-3.22 Discuss the assessment findings associated with headache. (C-1)
- 5-3.23 Discuss the management/ treatment plan of headache. (C-1)
- 5-3.24 Describe the epidemiology, including the morbidity/ mortality and prevention strategies, for neoplasms. (C-1)
- 5-3.25 Discuss the pathophysiology of neoplasms. (C-1)
- 5-3.26 Describe the types of neoplasms. (C-1)
- 5-3.27 Discuss the assessment findings associated with neoplasms. (C-1)
- 5-3.28 Discuss the management/ treatment plan of neoplasms. (C-1)
- 5-3.29 Define neoplasms. (C-1)
- 5-3.30 Recognize the signs and symptoms related to neoplasms. (C-1)
- 5-3.31 Correlate abnormal assessment findings with clinical significance in the patient with neoplasms. (C-3)
- 5-3.32 Differentiate among the various treatment and pharmacological interventions used in the management of neoplasms. (C-3)
- 5-3.33 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with neoplasms. (C-3)
- 5-3.34 Describe the epidemiology, including the morbidity/ mortality and prevention strategies, for abscess. (C-1)
- 5-3.35 Discuss the pathophysiology of abscess. (C-1)
- 5-3.36 Discuss the assessment findings associated with abscess. (C-1)
- 5-3.37 Discuss the management/ treatment plan of abscess. (C-1)
- 5-3.38 Define abscess. (C-1)
- 5-3.39 Recognize the signs and symptoms related to abscess. (C-1)
- 5-3.40 Correlate abnormal assessment findings with clinical significance in the patient with abscess. (C-3)

- 5-3.41 Differentiate among the various treatment and pharmacological interventions used in the management of abscess. (C-3)
- 5-3.42 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with abscess. (C-3)
- 5-3.43 Describe the epidemiology, including the morbidity/ mortality and prevention strategies, for stroke and intracranial hemorrhage. (C-1)
- 5-3.44 Discuss the pathophysiology of stroke and intracranial hemorrhage. (C-1)
- 5-3.45 Describe the types of stroke and intracranial hemorrhage. (C-1)
- 5-3.46 Discuss the assessment findings associated with stroke and intracranial hemorrhage. (C-1)
- 5-3.47 Discuss the management/ treatment plan of stroke and intracranial hemorrhage. (C-1)
- 5-3.48 Define stroke and intracranial hemorrhage. (C-1)
- 5-3.49 Recognize the signs and symptoms related to stroke and intracranial hemorrhage. (C-1)
- 5-3.50 Correlate abnormal assessment findings with clinical significance in the patient with stroke and intracranial hemorrhage. (C-3)
- 5-3.51 Differentiate among the various treatment and pharmacological interventions used in the management of stroke and intracranial hemorrhage. (C-3)
- 5-3.52 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with stroke and intracranial hemorrhage. (C-3)
- 5-3.53 Describe the epidemiology, including the morbidity/ mortality and prevention strategies, for transient ischemic attack. (C-3)
- 5-3.54 Discuss the pathophysiology of transient ischemic attack. (C-1)
- 5-3.55 Discuss the assessment findings associated with transient ischemic attack. (C-1)
- 5-3.56 Discuss the management/ treatment plan of transient ischemic attack. (C-1)
- 5-3.57 Define transient ischemic attack. (C-1)
- 5-3.58 Recognize the signs and symptoms related to transient ischemic attack. (C-1)
- 5-3.59 Correlate abnormal assessment findings with clinical significance in the patient with transient ischemic attack. (C-3)
- 5-3.60 Differentiate among the various treatment and pharmacological interventions used in the management of transient ischemic attack. (C-3)
- 5-3.61 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with transient ischemic attack. (C-3)
- 5-3.62 Describe the epidemiology, including the morbidity/ mortality and prevention strategies, for degenerative neurological diseases. (C-1)
- 5-3.63 Discuss the pathophysiology of degenerative neurological diseases. (C-1)
- 5-3.64 Discuss the assessment findings associated with degenerative neurological diseases. (C-1)
- 5-3.65 Discuss the management/ treatment plan of degenerative neurological diseases. (C-1)
- 5-3.66 Define the following: (C-1)
  - a. Muscular dystrophy
  - b. Multiple sclerosis
  - c. Dystonia
  - d. Parkinson's disease
  - e. Trigeminal neuralgia
  - f. Bell's palsy
  - g. Amyotrophic lateral sclerosis
  - h. Peripheral neuropathy
  - i. Myoclonus
  - j. Spina bifida
  - k. Poliomyelitis
- 5-3.67 Recognize the signs and symptoms related to degenerative neurological diseases. (C-1)

- 5-3.68 Correlate abnormal assessment findings with clinical significance in the patient with degenerative neurological diseases. (C-3)
- 5-3.69 Differentiate among the various treatment and pharmacological interventions used in the management of degenerative neurological diseases. (C-3)
- 5-3.70 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with degenerative neurological diseases. (C-3)
- 5-3.71 Integrate the pathophysiological principles of the patient with a neurological emergency. (C-3)
- 5-3.72 Differentiate between neurological emergencies based on assessment findings. (C-3)
- 5-3.73 Correlate abnormal assessment findings with the clinical significance in the patient with neurological complaints. (C-3)
- 5-3.74 Develop a patient management plan based on field impression in the patient with neurological emergencies. (C-3)

### **AFFECTIVE OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-3.75 Characterize the feelings of a patient who regains consciousness among strangers. (A-2)
- 5-3.76 Formulate means of conveying empathy to patients whose ability to communicate is limited by their condition. (A-3)

### **PSYCHOMOTOR OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-3.77 Perform an appropriate assessment of a patient with coma or altered mental status. (P-3)
- 5-3.78 Perform a complete neurological examination as part of the comprehensive physical examination of a patient with coma or altered mental status. (P-3)
- 5-3.79 Appropriately manage a patient with coma or altered mental status, including the administration of oxygen, oral glucose, 50% dextrose and narcotic reversal agents. (P-3)
- 5-3.80 Perform an appropriate assessment of a patient with syncope. (P-3)
- 5-3.81 Appropriately manage a patient with syncope. (P-3)
- 5-3.82 Perform an appropriate assessment of a patient with seizures. (P-3)
- 5-3.83 Appropriately manage a patient with seizures, including the administration of diazepam or lorazepam. (P-3)
- 5-3.84 Perform an appropriate assessment of a patient with stroke and intracranial hemorrhage or TIA. (P-3)
- 5-3.85 Appropriately manage a patient with stroke and intracranial hemorrhage or TIA. (P-3)
- 5-3.86 Demonstrate an appropriate assessment of a patient with a chief complaint of weakness. (P-3)



## DECLARATIVE

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
    - 2. Mortality/ morbidity
    - 3. Risk factors
    - 4. Prevention strategies
    - 5. Anatomy and physiology review
  
- II. General system pathophysiology, assessment and management
  - A. Physiology
    - 1. Alterations in cognitive systems
    - 2. Alterations in cerebral homeostasis
    - 3. Alterations in motor control
    - 4. Central nervous system disorders
      - a. Trauma
      - b. Cerebrovascular disorders
      - c. Tumors
      - d. Infection
      - e. Inflammation
      - f. Degenerative diseases
      - g. Hydrocephalus
    - 5. Peripheral nervous system disorders
    - 6. Neuromuscular junction disorders
  - B. Assessment findings
    - 1. History
      - a. General health
      - b. Previous medical conditions
      - c. Medications
      - d. Previous experience with complaint
      - e. Time of onset
      - f. Seizure activity
    - 2. Physical
      - a. General appearance
      - b. Assess for level of consciousness
        - (1) Mood
        - (2) Thought
        - (3) Perceptions
        - (4) Judgment
        - (5) Memory and attention
      - c. Speech
      - d. Skin
      - e. Posture and gait
      - f. Vital signs
        - (1) Hypertension
        - (2) Hypotension
        - (3) Heart rate/ fast or slow
        - (4) Ventilation rate/ quality
        - (5) Temperature/ fever

- g. Head/ neck
    - (1) Facial expression
    - (2) Eyes
      - (a) Acuity
      - (b) Fields
      - (c) Position & alignment
      - (d) Iris
      - (e) Pupils
      - (f) Extraocular muscles
    - (3) Ears
      - (a) Auditory acuity
    - (4) Nose
    - (5) Mouth
      - (a) Odors on breath
  - h. Thorax and lungs
    - (1) Auscultate
  - i. Cardiovascular
    - (1) Heart rate
    - (2) Rhythm
    - (3) Bruits
    - (4) Jugular vein pressure
    - (5) Auscultation
    - (6) ECG monitoring
  - j. Abdomen
  - k. Nervous
    - (1) Cranial nerves
    - (2) Motor system
      - (a) Muscle tone
      - (b) Muscle strength
      - (c) Flexion
      - (d) Extension
      - (e) Grip
      - (f) Coordination
  - l. Assessment tools
    - (1) Pulse oximetry
    - (2) End tidal CO<sub>2</sub>
    - (3) Blood glucose
3. Ongoing assessment
- C. Management
- 1. Airway and ventilatory support
    - a. Oxygen
    - b. Positioning
    - c. Assisted ventilation
    - d. Suction
    - e. Advanced airway device
  - 2. Circulatory support
    - a. Venous access
    - b. Blood analysis

3. Non-pharmacological interventions
    - a. Positioning
    - b. Spinal precautions
  4. Pharmacological interventions
    - a. Antianxiety agent
    - b. Anticonvulsant
    - c. Antiinflammatories
    - d. Diuretic
    - e. Sedative-hypnotic
    - f. Skeletal muscle relaxant
    - g. Hyperglycemic
    - h. Antihypoglycemic
    - i. Vitamin
    - j. Emetic
  5. Psychological support
  6. Transport considerations
    - a. Appropriate mode
    - b. Appropriate facility
- III. Specific injuries/ illnesses
- A. Stroke and intracranial hemorrhage
    1. Epidemiology
      - a. Incidence
      - b. Mortality/ morbidity
      - c. Risk factors
      - d. Prevention strategies
      - e. Anatomy and physiology review
    2. Pathophysiology of regional disruption of cerebral blood flow
      - a. Thrombus
      - b. Hemorrhage
        - (1) Subarachnoid
        - (2) Intracerebral
        - (3) Cerebellar
      - c. Embolus
    3. Assessment findings
      - a. History
        - (1) General health
        - (2) Previous medical conditions
        - (3) Medications
        - (4) Previous experience with complaint
        - (5) Time of onset
        - (6) Seizure activity
        - (7) Headache
        - (8) Nose bleed
        - (9) Others
      - b. Physical
        - (1) Standard physical exam for the patient with potential neurological event

- 4. Management
  - a. Airway and ventilatory support
    - (1) Oxygen
    - (2) Positioning
    - (3) Assisted ventilation
    - (4) Suction
    - (5) Advanced airway device
  - b0 Circulatory support
    - (1) Venous access
    - (2) Blood analysis
  - c0 Non-pharmacological interventions
    - (1) Positioning
    - (2) Spinal precautions
  - d0 Pharmacological interventions
    - (1) Anticonvulsants
    - (2) Antiinflammatories
    - (3) Vasodilator
    - (4) Diuretic
    - (5) Skeletal muscle relaxant
    - (6) Hyperglycemic
    - (7) Antihypoglycemic
    - (8) Vitamin
    - (9) Thrombolytics
    - (10) Neuroprotectives
  - e0 Psychological support
  - f0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
- B0 Transient ischemic attack
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
  - 2 Pathophysiology
    - a0 Transient neurological deficits
    - b0 Partial disruptions of blood flow
      - (1) Hemorrhagic
      - (2) Vasospasm
      - (3) Subarachnoid
      - (4) Intracerebral
      - (5) Cerebellar
    - c0 Partially occlusive
      - (1) Emboli
      - (2) Thrombi
  - 3 Assessment findings
    - a0 History
      - (1) General health
      - (2) Previous medical conditions

- (3) Medications
- (4) Previous experience with complaint
- (5) Time of onset
- (6) Seizures
- (7) Headache
- (8) Nosebleed
- b0 Physical
  - (1) Standard physical exam for patient with potential neurological event
- 4 Management
  - a0 Airway and ventilatory support
    - (1) Oxygen
    - (2) Positioning
    - (3) Assisted ventilation
    - (4) Suction
    - (5) Advanced airway device
  - b0 Circulatory support
    - (1) Venous access
    - (2) Blood analysis
  - c0 Non-pharmacological interventions
    - (1) Positioning
    - (2) Spinal precautions
  - d0 Pharmacological interventions
    - (1) Anticonvulsants
    - (2) Antiinflammatories
    - (3) Diuretic
    - (4) Skeletal muscle relaxant
    - (5) Hyperglycemic
    - (6) Anti-hypoglycemic
    - (7) Vitamin
  - e0 Psychological support
  - f0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
- C0 Epilepsy/ Seizures
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
  - 2 Pathophysiology
    - a0 Unexpected electrical discharge of neurons in brain
    - b0 Types
      - (1) Generalized
        - (a) Grand mal (tonic-clonic)
          - i Preictal phase (aura)
          - ii Tonic phase
          - iii Clonic phase
          - iv Postictal phase
        - (b) Tonic

- (c) Clonic
      - (d) Petit mal
    - (2) Partial
      - (a) Simple partial (e.g., Jacksonian)
      - (b) Complex partial (e.g., psychomotor or temporal lobe)
    - (3) Status epilepticus
  - c0 Causes other than epilepsy
    - (1) Idiopathic
    - (2) Fever
    - (3) Neoplasms
    - (4) Infection
    - (5) Metabolic
      - (a) Hypoxia
      - (b) Hypoglycemia
      - (c) Thyrotoxicosis
      - (d) Hypocalcemia
    - (6) Drug intoxication
    - (7) Drug withdrawal
    - (8) Head trauma
    - (9) Eclampsia
    - (10) Cerebral degenerative diseases
- 3 Assessment findings
  - a0 History
    - (1) General health
    - (2) Previous medical conditions
    - (3) Medications
    - (4) Previous seizures
    - (5) Time of onset
    - (6) Seizure activity
      - (a) Duration
      - (b) Number of events
      - (c) Consciousness between
  - b0 Physical
    - (1) Standard physical exam for patient with potential neurological event
    - (2) Pertinent findings
      - (a) Tongue laceration(s)
      - (b) Head
        - i Hemorrhage
        - ii Wounds
      - (c) GI/ GU
        - i Incontinence of bladder
        - ii Incontinence of bowel
- 4 Management
  - a0 Airway and ventilatory support
    - (1) Oxygen
    - (2) Positioning
    - (3) Assisted ventilation
    - (4) Suction
    - (5) Advanced airway device

- b0 Circulatory support
  - (1) Venous access
  - (2) Blood analysis
- c0 Non-pharmacological interventions
  - (1) Protection from injury
  - (2) Positioning
  - (3) Spinal precautions
- d0 Pharmacological interventions
  - (1) Anticonvulsants
  - (2) Antiinflammatories
  - (3) Skeletal muscle relaxant
  - (4) Hyperglycemic
  - (5) Anti-hypoglycemic
  - (6) Vitamin
- e0 Psychological support
- f0 Transport considerations
  - (1) Appropriate mode
  - (2) Appropriate facility
- D0 Syncope
  - 1 Pathophysiology
    - a0 Brief loss of consciousness caused by transient cerebral hypoxia
    - b0 Caused by lack of oxygen, glucose or seizure activity in the brain
  - 2 Assessment findings
    - a0 Perceived as a sensation of light-headedness
  - 3 Management
    - a0 Differentiate possible causes
      - (1) Seizure
      - (2) Other
    - b0 Airway management
    - c0 Oxygen
    - d0 Reassure
    - e0 Treat underlying cause
- E0 Headache
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
  - 2 Pathophysiology
    - a0 Primary
      - (1) Continuum of tension and migraine
    - b0 Cluster
      - (1) Unknown
    - c0 General thoughts
      - (1) Central serotonergic transmission abnormalities
      - (2) Vascular structure inflammation
      - (3) Neurogenic inflammation
      - (4) Platelet aggregation with release of vasoactive substances

- 3 Assessment findings
  - a0 History
    - (1) General health
    - (2) Previous medical conditions
    - (3) Medications
    - (4) Previous experience with complaint
    - (5) Time of onset
  - b0 Physical
    - (1) Standard exam for patient with potential neurological event
- 4 Management
  - a0 Airway and ventilatory support
    - (1) Oxygen
    - (2) Positioning
    - (3) Suction
    - (4) Assisted ventilation
    - (5) Suction
    - (6) Advanced airway device
  - b0 Circulatory support
    - (1) Venous access
    - (2) Blood analysis
  - c0 Non-pharmacological interventions
    - (1) General comfort measures
  - d0 Pharmacological interventions
    - (1) Antiemetics
    - (2) Rehydration
    - (3) Pain control
  - e0 Psychological support
  - f0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
- F0 Neoplasms
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
      - (1) Genetics
      - (2) Exposure to radiation
      - (3) Tobacco
      - (4) Occupational
      - (5) Pollution
      - (6) Medications
      - (7) Diet
      - (8) Viruses
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
  - 2 Pathophysiology
    - a0 Tumors
    - b0 Metabolic disorders
    - c0 Hematologic disorders
    - d0 Immunosuppression



- e0 Psychosocial effects
- f0 Staging
- g0 Types
- 3 Assessment findings
  - a0 History
    - (1) General health
    - (2) Previous medical conditions
    - (3) Medications
    - (4) Previous experience with complaint
    - (5) Time of onset
    - (6) Seizure activity
    - (7) Headache
    - (8) Nosebleed
    - (9) Type and timing of prior treatment
      - (a) Chemotherapy
      - (b) Radiation therapy
      - (c) Holistic and other nontraditional approaches
      - (d) Experimental treatment
  - b0 Physical
    - (1) Standard physical exam for patient with potential neurological event
- 4 Management
  - a0 Airway and ventilatory support
    - (1) Oxygen
    - (2) Positioning
    - (3) Assisted ventilation
    - (4) Suction
    - (5) Advanced airway device
  - b0 Circulatory support
    - (1) Venous access
    - (2) Blood analysis
  - c0 Non-pharmacological interventions
    - (1) Positioning
    - (2) Spinal precautions
  - d0 Pharmacological interventions
    - (1) Anticonvulsants
    - (2) Antiinflammatories
    - (3) Diuretic
    - (4) Skeletal muscle relaxant
    - (5) Hyperglycemic
    - (6) Antihypoglycemic
    - (7) Vitamin
  - e0 Psychological support
  - f0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
- G0 Abscess
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors

- d0 Prevention strategies
- e0 Anatomy and physiology review
- 2 Pathophysiology
- 3 Assessment findings
  - a0 History
    - (1) General health
    - (2) Previous medical conditions
    - (3) Medications
    - (4) Previous experience with complaint
    - (5) Time of onset
    - (6) Seizure activity
    - (7) Headache
  - b0 Physical
    - (1) Standard physical exam for patient with potential neurological event
- 4 Management
  - a0 Airway and ventilatory support
    - (1) Oxygen
    - (2) Positioning
    - (3) Assisted ventilation
    - (4) Suction
    - (5) Advanced airway device
  - b0 Circulatory support
    - (1) Venous access
    - (2) Blood analysis
  - c0 Non-pharmacological interventions
    - (1) Positioning
  - d0 Pharmacological interventions
  - e0 Psychological support
  - f0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
- H0 Degenerative neurological diseases
  - 1 Epidemiology
    - a0 Incidents
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
  - 2 Pathophysiology
    - a0 Muscular dystrophy
      - (1) Genetic disease
        - (a) DNA
      - (2) Degeneration of muscle fibers
      - (3) Biochemical defect
      - (4) Types
        - (a) Duchenne
        - (b) Fascioscapulohumeral
        - (c) Limb girdle
        - (d) Myotonic
    - (5) Effects on CNS

- (6) Incidence
- (7) Characteristics
- b0 Multiple sclerosis
  - (1) Inflammatory disease
  - (2) Immune disorder/ CNS myelin
  - (3) Demyelination of nerve sheaths
  - (4) Progressively deteriorate
  - (5) Effects on CNS
  - (6) Incidence
  - (7) Characteristics
- c0 Dystonia
  - (1) Alterations in muscle tone
  - (2) Inhibition of muscle
  - (3) Types
    - (a) Focal
    - (b) Secondary
    - (c) Torsion
    - (d) Spasm
    - (e) Tic
  - (4) Incidence
  - (5) Characteristics
  - (6) Iatrogenic
- d0 Parkinson's disease
  - (1) Degenerative disease basal ganglia
  - (2) Dopaminergic nigrostriatal pathway
  - (3) Primary and secondary disorders
  - (4) Incidence
    - (a) Occurs after 40 years
    - (b) Leading cause of neurologic disability >60 years
    - (c) 130 in 100,000 persons
    - (d) Estimated 500,000 in United States
  - (5) Characteristics
- e0 Central pain syndrome
  - (1) Trigeminal nerve infection or disease
  - (2) Tic douloureux
  - (3) Causes
    - (a) Tumor
    - (b) Lesions
    - (c) Medications (phenothiazine)
  - (4) Incidents
  - (5) Characteristics
- f0 Bell's palsy
  - (1) Facial paralysis
  - (2) Causes
    - (a) Post-trauma
    - (b) Herpes simplex
    - (c) Lyme disease
    - (d) Idiopathic

- (3 Incidence
    - (a Most common form of facial paralysis
    - (b 23 in 100,000 or 1 in 60 to 70 persons in a lifetime
  - (4 Characteristics
  - g. Amyotrophic lateral sclerosis
    - (1 Progressive motor neuron disease
    - (2 Types
      - (a Spinal muscular atrophy
      - (b Bulbar palsy
      - (c Primary lateral sclerosis
      - (d Pseudobulbar palsy
    - (3 Incidence
    - (4 Characteristics
  - h. Peripheral neuropathy
    - (1 Axons/ spinal cord neurons injured
    - (2 Autonomic nerve fibers
    - (3 Incidence
    - (4 Characteristics
  - i. Myoclonus
    - (1 Involuntary random muscular contractions
    - (2 Fasciculation
    - (3 Metabolic and neurologic disorders
    - (4 Incidence
    - (5 Characteristics
  - j. Spina bifida
    - (1 Defects of neural tube closure
      - (a Meningocele
      - (b Myelomeningocele
    - (2 Vertebral defect
    - (3 Incidence
    - (4 Characteristics
  - k. Polio (poliomyelitis)
    - (1 Acute infectious inflammation of gray matter of spinal cord
    - (2 Enteroviruses
    - (3 Pathways
      - (a Blood-CNS barrier
      - (b Motor neuron
    - (4 Histopathologic findings
    - (5 Progressive
    - (6 Incidence
    - (7 Characteristics
3. Assessment findings
- a. History
    - (1 Acute or chronic
    - (2 General health
    - (3 Previous medical conditions
    - (4 Medications
    - (5 Experience with complaint
    - (6 Time of onset
    - (7 Seizure activity

- b. Physical
  - (1 Standard physical exam for patient with potential neurological event
- 4. Management
  - a. Airway and ventilatory support
    - (1 Oxygen
    - (2 Positioning
  - b. Circulatory support
    - (1 Venous access
    - (2 Blood analysis
  - c. Non-pharmacological interventions
    - (1 Positioning
  - d. Pharmacological interventions
    - (1 Hyperglycemic
    - (2 Antihypoglycemic
    - (3 Antihistamine (for medication-caused dystonic reactions)
    - (4 Analgesics
    - (5 Steroids
    - (6 Dopaminergics
  - e. Psychological support
  - f. Transport considerations
    - (1 Appropriate mode
    - (2 Appropriate facility

IV. Integration

- A. Develop management strategies, based on the pathophysiological principles, for the following patient presentations
  - 1. Coma/ decreased level of consciousness
  - 2. Headache
  - 3. Weakness
  - 4. Vertigo
  - 5. Seizure

### **UNIT TERMINAL OBJECTIVE**

- 5-4 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with an endocrine problem.

### **COGNITIVE OBJECTIVE**

At the completion of this unit, the paramedic student will be able to:

- 5-4.1 Describe the incidence, morbidity and mortality of endocrinologic emergencies. (C-1)
- 5-4.2 Identify the risk factors most predisposing to endocrinologic disease. (C-1)
- 5-4.3 Discuss the anatomy and physiology of organs and structures related to endocrinologic diseases. (C-1)
- 5-4.4 Review the pathophysiology of endocrinologic emergencies. (C-1)
- 5-4.5 Discuss the general assessment findings associated with endocrinologic emergencies. (C-1)
- 5-4.6 Identify the need for rapid intervention of the patient with endocrinologic emergencies. (C-1)
- 5-4.7 Discuss the management of endocrinologic emergencies. (C-1)
- 5-4.8 Describe osmotic diuresis and its relationship to diabetes. (C-1)
- 5-4.9 Describe the pathophysiology of adult onset diabetes mellitus. (C-1)
- 5-4.10 Describe the pathophysiology of juvenile onset diabetes mellitus. (C-1)
- 5-4.11 Describe the effects of decreased levels of insulin on the body. (C-1)
- 5-4.12 Correlate abnormal findings in assessment with clinical significance in the patient with a diabetic emergency. (C-3)
- 5-4.13 Discuss the management of diabetic emergencies. (C-1)
- 5-4.14 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with a diabetic emergency. (C-3)
- 5-4.15 Differentiate between the pathophysiology of normal glucose metabolism and diabetic glucose metabolism. (C-3)
- 5-4.16 Describe the mechanism of ketone body formation and its relationship to ketoacidosis. (C-1)
- 5-4.17 Discuss the physiology of the excretion of potassium and ketone bodies by the kidneys. (C-1)
- 5-4.18 Describe the relationship of insulin to serum glucose levels. (C-1)
- 5-4.19 Describe the effects of decreased levels of insulin on the body. (C-1)
- 5-4.20 Describe the effects of increased serum glucose levels on the body. (C-1)
- 5-4.21 Discuss the pathophysiology of hypoglycemia. (C-1)
- 5-4.22 Discuss the utilization of glycogen by the human body as it relates to the pathophysiology of hypoglycemia. (C-3)
- 5-4.23 Describe the actions of epinephrine as it relates to the pathophysiology of hypoglycemia. (C-3)
- 5-4.24 Recognize the signs and symptoms of the patient with hypoglycemia. (C-1)
- 5-4.25 Describe the compensatory mechanisms utilized by the body to promote homeostasis relative to hypoglycemia. (C-1)
- 5-4.26 Describe the management of a responsive hypoglycemic patient. (C-1)
- 5-4.27 Correlate abnormal findings in assessment with clinical significance in the patient with hypoglycemia. (C-1)
- 5-4.28 Discuss the management of the hypoglycemic patient. (C-1)
- 5-4.29 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with hypoglycemia. (C-3)
- 5-4.30 Discuss the pathophysiology of hyperglycemia. (C-1)
- 5-4.31 Recognize the signs and symptoms of the patient with hyperglycemia. (C-1)
- 5-4.32 Describe the management of hyperglycemia. (C-1)
- 5-4.33 Correlate abnormal findings in assessment with clinical significance in the patient with hyperglycemia. (C-3)
- 5-4.34 Discuss the management of the patient with hyperglycemia. (C-1)
- 5-4.35 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with hyperglycemia. (C-3)

- 5-4.36 Discuss the pathophysiology of nonketotic hyperosmolar coma. (C-1)
- 5-4.37 Recognize the signs and symptoms of the patient with nonketotic hyperosmolar coma. (C-1)
- 5-4.38 Describe the management of nonketotic hyperosmolar coma. (C-1)
- 5-4.39 Correlate abnormal findings in assessment with clinical significance in the patient with nonketotic hyperosmolar coma. (C-3)
- 5-4.40 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with nonketotic hyperosmolar coma. (C-3)
- 5-4.41 Discuss the management of the patient with hyperglycemia. (C-1)
- 5-4.42 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with hyperglycemia. (C-3)
- 5-4.43 Discuss the pathophysiology of diabetic ketoacidosis. (C-1)
- 5-4.44 Recognize the signs and symptoms of the patient with diabetic ketoacidosis. (C-1)
- 5-4.45 Describe the management of diabetic ketoacidosis. (C-1)
- 5-4.46 Correlate abnormal findings in assessment with clinical significance in the patient with diabetic ketoacidosis. (C-3)
- 5-4.47 Discuss the management of the patient with diabetic ketoacidosis. (C-1)
- 5-4.48 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with diabetic ketoacidosis. (C-3)
- 5-4.49 Discuss the pathophysiology of thyrotoxicosis. (C-1)
- 5-4.50 Recognize signs and symptoms of the patient with thyrotoxicosis. (C-1)
- 5-4.51 Describe the management of thyrotoxicosis. (C-1)
- 5-4.52 Correlate abnormal findings in assessment with clinical significance in the patient with thyrotoxicosis. (C-3)
- 5-4.53 Discuss the management of the patient with thyrotoxicosis. (C-1)
- 5-4.54 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with thyrotoxicosis. (C-3)
- 5-4.55 Discuss the pathophysiology of myxedema. (C-1)
- 5-4.56 Recognize signs and symptoms of the patient with myxedema. (C-1)
- 5-4.57 Describe the management of myxedema. (C-1)
- 5-4.58 Correlate abnormal findings in assessment with clinical significance in the patient with myxedema. (C-3)
- 5-4.59 Discuss the management of the patient with myxedema. (C-1)
- 5-4.60 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with myxedema. (C-3)
- 5-4.61 Discuss the pathophysiology of Cushing's syndrome. (C-1)
- 5-4.62 Recognize signs and symptoms of the patient with Cushing's syndrome. (C-1)
- 5-4.63 Describe the management of Cushing's syndrome. (C-1)
- 5-4.64 Correlate abnormal findings in assessment with clinical significance in the patient with Cushing's syndrome. (C-3)
- 5-4.65 Discuss the management of the patient with Cushing's syndrome. (C-1)
- 5-4.66 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with Cushing's syndrome. (C-3)
- 5-4.67 Discuss the pathophysiology of adrenal Insufficiency. (C-1)
- 5-4.68 Recognize signs and symptoms of the patient with adrenal insufficiency. (C-1)
- 5-4.69 Describe the management of adrenal insufficiency. (C-1)
- 5-4.70 Correlate abnormal findings in assessment with clinical significance in the patient with adrenal insufficiency. (C-3)
- 5-4.71 Discuss the management of the patient with adrenal insufficiency. (C-1)
- 5-4.72 Integrate the pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with adrenal insufficiency. (C-3)
- 5-4.73 Integrate the pathophysiological principles to the assessment of a patient with a endocrinological emergency. (C-3)
- 5-4.74 Differentiate between endocrine emergencies based on assessment and history. (C-3)

- 5-4.75 Correlate abnormal findings in the assessment with clinical significance in the patient with endocrinologic emergencies. (C-3)
- 5-4.76 Develop a patient management plan based on field impression in the patient with an endocrinologic emergency. (C-3)

**AFFECTIVE OBJECTIVES**

None identified for this unit.

**PSYCHOMOTOR OBJECTIVES**

None identified for this unit.



## DECLARATIVE

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
    - 2. Mortality/ morbidity
    - 3. Risk factors
    - 4. Prevention strategies
  - B. Anatomy and physiology
- II. General pathophysiology, assessment and management
  - A. Pathophysiology
    - 1. Endocrine system
      - a. Integrated chemical and coordination system enabling
        - (1) Reproduction
        - (2) Growth and development
        - (3) Regulation of energy
      - b. Works with the nervous system to help
        - (1) Maintain an internal homeostasis of the body
        - (2) Coordinate responses to environmental changes and stress
      - c. Composed of glands or glandular tissue that synthesize, store and secrete chemical messengers (hormones) that affect specific target organs and body tissues
      - d. Specificity of this system is determined by the affinity of receptors on target organs and body tissues to a particular hormone
    - 2. Endocrine glands
      - a. Ductless glands
        - (1) Highly vascular
        - (2) Synthesize and secrete hormones
        - (3) Specific glands
          - (a) Hypothalamus
          - (b) Pituitary
          - (c) Thyroid
          - (d) Parathyroid
          - (e) Adrenal
          - (f) Kidneys
          - (g) Pancreatic islets
          - (h) Ovaries
          - (i) Testes
          - (j) Hormones
        - (4) Common characteristics
          - (a) Circulation through the blood
          - (b) Secretion of minute but effective amounts at predictable but variable intervals bind to specific cellular receptors to change intercellular metabolism
        - (5) Structure
  - B. Assessment findings
    - 1. Scene size-up
      - a. Scene safety
      - b. Personal protective equipment (PPE)

- (1) General impression
      - (2) Trauma
        - (a) Responsive
        - (b) Unresponsive
      - (3) Medical
        - (a) Responsive
        - (b) Unresponsive
    - c. Nature of illness
  - 2. Initial assessment
    - a. Airway
    - b. Breathing
    - c. Circulation
    - d. Disability
    - e. Chief complaint
  - 3. Focused history
    - a. Onset
    - b. Provoking factors
    - c. Time
    - d. Nausea/ vomiting
    - e. Weight loss
    - f. Last meal
    - g. Non-specific
    - h. Changes in
      - (1) Energy level
      - (2) Alertness
      - (3) Sleep patterns
      - (4) Mood
      - (5) Affect
      - (6) Weight
      - (7) Skin
      - (8) Hair
      - (9) Personal appearance
      - (10) Sexual function
    - i. Specific history of
      - (1) Hypopituitarism
      - (2) Hypothyroidism
      - (3) Polydipsia
      - (4) Polyuria
      - (5) Polyphagia
      - (6) Diabetes
      - (7) Exophthalmus in hyperthyroidism
  - 4. Focused physical examination
    - a. Appearance
    - b. Level of consciousness
    - c. Apparent state of health
    - d. Skin color
    - e. Vital signs
- C. Management/ treatment plan
  - 1. Airway and ventilatory support
    - a. Maintain an open airway
    - b. High flow oxygen

2. Circulatory support
  - a. Monitor blood pressure
3. Pharmacological interventions
  - a. Consider initiating intravenous line
  - b. Avoid interventions which mask signs and symptoms
4. Non-pharmacological interventions
  - a. Monitor LOC
  - b. Monitor vital signs
5. Transport consideration
  - a. Appropriate mode
  - b. Appropriate facility
6. Psychological support
  - a. All actions reflect a calm, caring, competent attitude
  - b. Keep patient and significant others informed of your actions

III. Specific illnesses

A. Diabetes mellitus

1. Epidemiology
  - a. Incidence
  - b. Morbidity/ mortality
  - c. Long term complications
  - d. Risk factors
  - e. Prevention strategies
2. Anatomy and physiology review
3. Pathophysiology
  - a. Types
    - (1) Type I-insulin dependent
    - (2) Type II-non insulin dependent
  - b. A chronic system syndrome characterized by hyperglycemia caused by a decrease in the secretion or activity of insulin
  - c. Normal insulin metabolism
    - (1) Produced by beta cells in the islets of Langerhans
    - (2) Continuously released into the bloodstream
      - (a) Insulin is released from the beta cells as proinsulin
      - (b) Routed through the liver where 50-70 percent is extracted from the blood
      - (c) The level of plasma insulin rises after a meal
        - i) Stimulates storage of glucose as glycogen, liver and muscle tissue
        - ii) Enhances fat deposition in adipose tissue
        - iii) Inhibits protein degradation
        - iv) Accelerates protein synthesis
      - (d) The fall of plasma insulin levels during normal overnight fasting facilitates the release of
        - i) Stored glucose from the liver
        - ii) Protein from muscle tissue
        - iii) Fat from adipose tissue
      - (e) Average daily secretion is 0.6 units per kilogram of body weight

- (3) Activity of released insulin
  - (a) Lowers blood glucose levels
  - (b) Facilitates a stable, normal glucose range of approximately 70 to 120 mg/ dl
- d. Ketone formation
  - (1) When insulin supply is insufficient, glucose cannot be used for cellular energy
  - (2) Response to cellular starvation
  - (3) Body releases and breaks down stored fats and protein to provide energy
  - (4) Free fatty acids from stored triglycerides are released and metabolized in the liver in such large quantities that ketones are formed
  - (5) Excess ketones upset the pH balance and acidosis develops
  - (6) Gluconeogenesis from protein is the last source used by the body as a compensatory response to provide cellular energy
    - (a) Results in an increase in glucose and nitrogen
    - (b) Due to prevailing insulin insufficiency, the glucose can not be used resulting in
      - i) Increased osmotic diuresis
      - ii) Dehydration and loss of electrolytes, particularly potassium
- 4. Assessment findings
  - a. History
    - (1) Has insulin dosage changed recently?
    - (2) Has the patient had a recent infection?
    - (3) Has the patient suffered any psychologic stress?
  - b. Signs and symptoms
    - (1) Altered mental status
    - (2) Abnormal respiratory pattern (Kussmaul's breathing)
    - (3) Tachycardia
    - (4) Hypotension
    - (5) Breath has a distinct fruity odor
    - (6) Polydipsia
    - (7) Polyphagia
    - (8) Warm dry skin
    - (9) Weight loss
    - (10) Weakness
    - (11) Dehydration
- 5. Management
  - a. Airway and ventilation
  - b. Circulation
  - c. Pharmacological interventions
  - d. Non-pharmacological interventions
  - e. Transport consideration
    - (1) Appropriate mode
    - (2) Appropriate facility
  - f. Psychological support/ communication strategies
- B. Hypoglycemia
  - 1. Epidemiology
    - a. Incidence
    - b. Morbidity/ mortality

- c. Risk factors
- d. Prevention strategies
- 2. Pathophysiology
  - a. Blood glucose levels fall below that required for normal body functioning
  - b0 Combined effects of a decreased energy supply to the central nervous system and a hyperadrenergic state results from a compensatory increase in catecholamine secretion
    - (1) Tremors
    - (2) Diaphoresis
    - (3) Palpitations
    - (4) Tachycardia
    - (5) Pale, cool skin
    - (6) Low levels of blood glucose reaching the brain results in an altered mental status
    - (7) Irritability
    - (8) Confusion
    - (9) Stupor
    - (10) Coma
- 3. Assessment
  - a0 Known history of
    - (1) Diabetes
    - (2) Prolonged fasting
    - (3) Alcoholism
  - b0 Signs and symptoms
    - (1) Weakness
    - (2) Irritability
    - (3) Hunger
    - (4) Confusion
    - (5) Anxiety
    - (6) Bizarre behavior
    - (7) Tachycardia
    - (8) Normal respiratory pattern
    - (9) Cool, pale skin
    - (10) Diaphoresis
- 4. Management
  - a0 Airway and ventilation
  - b0 Circulation
  - c0 Pharmacological interventions
  - d0 Non-pharmacological interventions
  - e0 Transport consideration
    - (1) Appropriate mode
    - (2) Appropriate facility
    - (3) Psychological support/ communication strategies
- C0 Hyperglycemia (hyperglycemic hyperosmolar nonketosis)
  - 1. Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies

- 2 Pathophysiology
  - a0 Occurs in patients with diabetes who are able to produce enough insulin to prevent DKA but not enough to prevent severe hyperglycemia, osmotic diuresis and extracellular fluid depletion
  - b0 Increasing blood glucose levels causes a fluid shift from intracellular to extracellular spaces
- 3 Assessment
  - a0 Known history of
    - (1) Diabetes
    - (2) Inadequate fluid intake
  - b0 Signs and symptoms
    - (1) Neurologic abnormalities
      - (a) Somnolence
      - (b) Coma
      - (c) Seizures
      - (d) Hemiparesis
      - (e) Aphasia
      - (f) Increasing mental depression
      - (g) Dehydration
      - (h) Polydipsia
      - (i) Polyuria
      - (j) Polyphagia
- 4 Management
  - a0 Airway and ventilatory support
  - b0 Circulation
  - c0 Pharmacological interventions
  - d0 Non-pharmacological interventions
  - e0 Transport consideration
    - (1) Appropriate mode
    - (2) Appropriate facility
  - f0 Psychological support/ communication strategies
- D0 Diabetic ketoacidosis
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
  - 2 Pathophysiology
    - a0 Hyperglycemia
    - b0 Ketonemia
    - c0 Relative insulin insufficiency
    - d0 Counterregulatory hormone excess
  - 3 Assessment findings
    - a0 History
      - (1) General health
      - (2) Previous medical conditions
      - (3) Medications
      - (4) Previous experience with complaint
      - (5) Time of onset

- b0 Physical
      - (1) Dehydration
      - (2) Hypotension
      - (3) Reflex tachycardia
      - (4) Acetone (fruity) odor on breath
      - (5) Nausea
      - (6) Vomiting
      - (7) Abdominal pain
      - (8) Hyperventilation
      - (9) Kussmaul's respiration
  - 4 Management
    - a0 Airway and ventilatory support
      - (1) Oxygen
      - (2) Positioning
      - (3) Suction
      - (4) Assisted ventilation
      - (5) Suction
      - (6) Advanced airway devices
    - b0 Circulatory support
      - (1) Venous access
      - (2) Blood analysis
    - c0 Non-pharmacological interventions
      - (1) General comfort measures
    - d0 Pharmacological interventions
      - (1) Rehydration
      - (2) Bicarbonate
      - (3) Potassium
      - (4) Insulin
    - e0 Psychological support
    - f0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
- E0 Thyrotoxicosis (thyroid storm)
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
  - 2 Pathophysiology
    - a0 Acute manifestation of all hyperthyroid symptoms
    - b0 Excessive circulating level of thyroxine and triiodothyronine
      - (1) Regulate metabolism
      - (2) Regulate growth and development
  - 3 Assessment
    - a0 History
    - b0 Signs and symptoms
      - (1) Severe tachycardia
      - (2) Heart failure
      - (3) Cardiac dysrhythmias
      - (4) Shock
      - (5) Hyperthermia

- (6) Restlessness
- (7) Agitation
- (8) Abdominal pain
- (9) Delirium
- (10) Coma
- 4 Management
  - a0 Airway and ventilation
  - b0 Circulation
  - c0 Pharmacological interventions
    - (1) Anti-thyroid drugs - in hospital management
    - (2) Beta adrenergic receptor blockers
  - d0 Non-pharmacological interventions
  - e0 Transport consideration
    - (1) Appropriate mode
    - (2) Appropriate facility
  - f0 Psychological support/ communication strategies
- F0 Myxedema (adult hypothyroidism)
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
  - 2 Pathophysiology
    - a0 A disease caused by hyposecretion of the thyroid gland during the adult years
  - 3 Assessment
    - a0 History
    - b0 Signs and symptoms
      - (1) Edematous face
      - (2) Periorbital edema
      - (3) Mask-like effect
      - (4) Impaired memory
      - (5) Slowed speech
      - (6) Decreased initiative
      - (7) Somnolence
      - (8) Cold intolerance
      - (9) Dry, coarse skin
      - (10) Muscle weakness and swelling
      - (11) Constipation
      - (12) Weight gain
      - (13) Hair loss
      - (14) Hoarseness
  - 4 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological interventions
    - d0 Non-pharmacological interventions
    - e0 Transport consideration
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological support/ communication strategies



- IV Corticosteroid excess - Cushing's syndrome
  - A0 Epidemiology
    - 1 Incidence
    - 2 Mortality/ morbidity
    - 3 Risk factors
    - 4 Prevention strategies
  - B0 Pathophysiology
    - 1 A spectrum of clinical abnormalities caused by an excess of corticosteroids, especially glucocorticoids
    - 2 Causes
      - a0 Corticotropin secreting pituitary tumor
      - b0 Cortical secreting neoplasm within the adrenal cortex
      - c0 Excess secretion of corticotropin by a malignant growth outside the adrenal
      - d0 Prolongs administration of high dose corticosteroids
  - C0 Assessment
    - 1 History
    - 2 Signs and symptoms
      - a0 Thinning hair
      - b0 Acnes
      - c0 Hump on back of neck (buffalo hump)
      - d0 Supraclavicular fat pad
      - e0 Thin extremities
      - f0 Ecchymosis
      - g0 Slow healing
      - h0 Pendulous abdomen
      - i0 Weight gain
      - j0 Increased body and facial hair
  - D0 Management
    - 1 Airway and ventilation
    - 2 Circulation
    - 3 Pharmacological interventions
    - 4 Non-pharmacological interventions
    - 5 Transport consideration
      - a0 Appropriate mode
      - b0 Appropriate facility
    - 6 Psychological support/ communication strategies
- V Adrenal insufficiency - Addison's disease
  - A0 Epidemiology
    - 1 Incidence
    - 2 Mortality/ morbidity
    - 3 Risk factors
    - 4 Prevention strategies
  - B0 Pathophysiology
    - 1 Adrenal insufficiency
      - a0 Adrenal steroids are reduced
        - (1) Glucocorticoids
        - (2) Mineralocorticoids
        - (3) Androgens
    - 2 Most common cause is idiopathic atrophy of adrenal tissue

- 3 Less common causes include hemorrhage, infarctions, fungal infections and acquired immune deficiency disease
- C0 Assessment
  - 1 History
  - 2 Signs and symptoms
    - a0 Progressive weakness
    - b0 Progressive weight loss
    - c0 Progressive anorexia
    - d0 Skin hyperpigmentation
      - (1) Areas exposed to the sun
      - (2) Areas exposed to pressure points
      - (3) Joints and creases
    - e0 Hypotension
    - f0 Hyponatremia
    - g0 Hyperkalemia
    - h0 Nausea
    - i0 Vomiting
    - j0 Diarrhea
- D0 Management
  - 1 Airway and ventilation
  - 2 Circulation
  - 3 Pharmacological interventions
  - 4 Non-pharmacological interventions
  - 5 Transport consideration
    - a0 Appropriate mode
    - b0 Appropriate facility
  - 6 Psychological support/ communication strategies
- VI Integration

**UNIT TERMINAL OBJECTIVE**

5-5 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with an allergic or anaphylactic reaction.

**COGNITIVE OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-5.1 Define allergic reaction. (C-1)
- 5-5.2 Define anaphylaxis. (C-1)
- 5-5.3 Describe the incidence, morbidity and mortality of anaphylaxis. (C-1)
- 5-5.4 Identify the risk factors most predisposing to anaphylaxis. (C-1)
- 5-5.5 Discuss the anatomy and physiology of the organs and structures related to anaphylaxis. (C-1)
- 5-5.6 Describe the prevention of anaphylaxis and appropriate patient education. (C-1)
- 5-5.7 Discuss the pathophysiology of allergy and anaphylaxis. (C-1)
- 5-5.8 Describe the common methods of entry of substances into the body. (C-1)
- 5-5.9 Define natural and acquired immunity. (C-1)
- 5-5.10 Define antigens and antibodies. (C-1)
- 5-5.11 List common antigens most frequently associated with anaphylaxis. (C-1)
- 5-5.12 Discuss the formation of antibodies in the body. (C-1)
- 5-5.13 Describe physical manifestations in anaphylaxis. (C-1)
- 5-5.14 Differentiate manifestations of an allergic reaction from anaphylaxis. (C-3)
- 5-5.15 Recognize the signs and symptoms related to anaphylaxis. (C-1)
- 5-5.16 Differentiate among the various treatment and pharmacological interventions used in the management of anaphylaxis. (C-3)
- 5-5.17 Integrate the pathophysiological principles of the patient with anaphylaxis. (C-3)
- 5-5.18 Correlate abnormal findings in assessment with the clinical significance in the patient with anaphylaxis. (C-3)
- 5-5.19 Develop a treatment plan based on field impression in the patient with allergic reaction and anaphylaxis. (C-3)

**AFFECTIVE OBJECTIVES**

None identified for this unit.

**PSYCHOMOTOR OBJECTIVES**

None identified for this unit.

## DECLARATIVE

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
    - 2. Morbidity/ mortality
    - 3. Risk factors
    - 4. Prevention
  - B. Anatomy
    - 1. Review of cardiovascular system
    - 2. Review of respiratory system
    - 3. Review of nervous system
    - 4. Review of gastrointestinal system
  - C. Physiology
    - 1. Antigens
    - 2. Antibodies
      - a. IgE
  - D. Terminology
    - 1. Allergic reaction
    - 2. Anaphylaxis
  
- II. Pathophysiology
  - A. Allergen
  - B. Routes of entry
    - 1. Oral ingestion
    - 2. Injected/ envenomation
    - 3. Inhaled
    - 4. Topical
  - C. Common allergens
    - 1. Drugs
    - 2. Insects
    - 3. Foods
    - 4. Animals
    - 5. Other
  - D. Allergic response
    - 1. Histamine or histamine-like substance release
    - 2. Biphasic response
      - a. Acute reaction
      - b. Delayed reaction
    - 3. Immunity
    - 4. Sensitivity
    - 5. Hypersensitivity
  - E. Urticaria
    - 1. Redness of skin
  - F. Angioneurotic
    - 1. Swelling/ edema of the skin
  - G. Anaphylactic shock
    - 1. Cardiovascular system
    - 2. Respiratory system
    - 3. Gastrointestinal system
    - 4. Nervous system

- III. Assessment findings
  - A. Not all signs and symptoms are present in every case
  - B. History
    - 1. Previous exposure
    - 2. Previous experience to exposure
    - 3. Onset of symptoms
    - 4. Dyspnea
  - C. Level of consciousness
    - 1. Unable to speak
    - 2. Restless
    - 3. Decreased level of consciousness
    - 4. Unresponsive
  - D. Upper airway
    - 1. Hoarseness
    - 2. Stridor
    - 3. Pharyngeal edema/ spasm
  - E. Lower airway
    - 1. Tachypnea
    - 2. Hypoventilation
    - 3. Labored - accessory muscle use
    - 4. Abnormal retractions
    - 5. Prolonged expirations
    - 6. Wheezes
    - 7. Diminished lung sounds
  - F. Skin
    - 1. Redness
    - 2. Rashes
    - 3. Edema
    - 4. Moisture
    - 5. Itching
    - 6. Urticaria
    - 7. Pallor
    - 8. Cyanotic
  - G. Vital signs
    - 1. Tachycardia
    - 2. Hypotension
  - H. Gastrointestinal
    - 1. Abnormal crampings
    - 2. Nausea/ vomiting
    - 3. Diarrhea
  - I. Assessment tools
    - 1. Cardiac monitor
    - 2. Pulse oximetry low
    - 3. End tidal CO<sub>2</sub> high
- IV. Management of anaphylaxis
  - A. Remove offending agent (i.e. remove stinger)
  - B. Airway and ventilation
    - 1. Positioning
    - 2. Oxygen

- 3. Assist ventilation
    - 4. Advanced airway
  - C. Circulation
    - 1. Venous access
    - 2. Fluid resuscitation
  - D. Pharmacological
    - 1. Oxygen
    - 2. Epinephrine - main stay of treatment
      - a. Bronchodilator
      - b. Decrease vascular permeability
    - 3. Antihistamine
    - 4. Antiinflammatory/ immunosuppressant
    - 5. Vasopressor
  - E. Psychological support
  - F. Transport considerations
- V. Management of allergic reaction
  - A. Without dyspnea
    - 1. Antihistamine
  - B. With dyspnea
    - 1. Oxygen
    - 2. Subcutaneous epinephrine
    - 3. Antihistamine
- VI. Patient Education

**UNIT TERMINAL OBJECTIVE**

- 5-6 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement the treatment plan for the patient with a gastroenterologic problem.

**COGNITIVE OBJECTIVE**

At the conclusion of this unit, the paramedic student will be able to:

- 5-6.1 Describe the incidence, morbidity and mortality of gastrointestinal emergencies. (C-1)
- 5-6.2 Identify the risk factors most predisposing to gastrointestinal emergencies. (C-1)
- 5-6.3 Discuss the anatomy and physiology of the organs and structures related to gastrointestinal diseases. (C-1)
- 5-6.4 Discuss the pathophysiology of inflammation and its relationship to acute abdominal pain. (C-1)
- 5-6.5 Define somatic pain as it relates to gastroenterology. (C-1)
- 5-6.6 Define visceral pain as it relates to gastroenterology. (C-1)
- 5-6.7 Define referred pain as it relates to gastroenterology. (C-1)
- 5-6.8 Differentiate between hemorrhagic and non-hemorrhagic abdominal pain. (C-3)
- 5-6.9 Discuss the signs and symptoms of local inflammation relative to acute abdominal pain. (C-1)
- 5-6.10 Discuss the signs and symptoms of peritoneal inflammation relative to acute abdominal pain. (C-1)
- 5-6.11 List the signs and symptoms of general inflammation relative to acute abdominal pain. (C-1)
- 5-6.12 Based on assessment findings, differentiate between local, peritoneal and general inflammation as they relate to acute abdominal pain. (C-3)
- 5-6.13 Describe the questioning technique and specific questions the paramedic should ask when gathering a focused history in a patient with abdominal pain. (C-1)
- 5-6.14 Describe the technique for performing a comprehensive physical examination on a patient complaining of abdominal pain. (C-1)
- 5-6.15 Define upper gastrointestinal bleeding. (C-1)
- 5-6.16 Discuss the pathophysiology of upper gastrointestinal bleeding. (C-1)
- 5-6.17 Recognize the signs and symptoms related to upper gastrointestinal bleeding. (C-1)
- 5-6.18 Describe the management for upper gastrointestinal bleeding. (C-1)
- 5-6.19 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with upper GI bleeding. (C-3)
- 5-6.20 Define lower gastrointestinal bleeding. (C-1)
- 5-6.21 Discuss the pathophysiology of lower gastrointestinal bleeding. (C-1)
- 5-6.22 Recognize the signs and symptoms related to lower gastrointestinal bleeding. (C-1)
- 5-6.23 Describe the management for lower gastrointestinal bleeding. (C-1)
- 5-6.24 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with lower GI bleeding. (C-3)
- 5-6.25 Define acute gastroenteritis. (C-1)
- 5-6.26 Discuss the pathophysiology of acute gastroenteritis. (C-1)
- 5-6.27 Recognize the signs and symptoms related to acute gastroenteritis. (C-1)
- 5-6.28 Describe the management for acute gastroenteritis. (C-1)
- 5-6.29 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with acute gastroenteritis. (C-3)
- 5-6.30 Define colitis. (C-1)
- 5-6.31 Discuss the pathophysiology of colitis. (C-1)
- 5-6.32 Recognize the signs and symptoms related to colitis. (C-1)
- 5-6.33 Describe the management for colitis. (C-1)
- 5-6.34 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with colitis. (C-3)
- 5-6.35 Define gastroenteritis. (C-1)

- 5-6.36 Discuss the pathophysiology of gastroenteritis. (C-1)
- 5-6.37 Recognize the signs and symptoms related to gastroenteritis. (C-1)
- 5-6.38 Describe the management for gastroenteritis. (C-1)
- 5-6.39 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with gastroenteritis. (C-3)
- 5-6.40 Define diverticulitis. (C-1)
- 5-6.41 Discuss the pathophysiology of diverticulitis. (C-1)
- 5-6.42 Recognize the signs and symptoms related to diverticulitis. (C-1)
- 5-6.43 Describe the management for diverticulitis. (C-1)
- 5-6.44 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with diverticulitis. (C-3)
- 5-6.45 Define appendicitis. (C-1)
- 5-6.46 Discuss the pathophysiology of appendicitis. (C-1)
- 5-6.47 Recognize the signs and symptoms related to appendicitis. (C-1)
- 5-6.48 Describe the management for appendicitis. (C-1)
- 5-6.49 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with appendicitis. (C-3)
- 5-6.50 Define peptic ulcer disease. (C-1)
- 5-6.51 Discuss the pathophysiology of peptic ulcer disease. (C-1)
- 5-6.52 Recognize the signs and symptoms related to peptic ulcer disease. (C-1)
- 5-6.53 Describe the management for peptic ulcer disease. (C-1)
- 5-6.54 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with peptic ulcer disease. (C-3)
- 5-6.55 Define bowel obstruction. (C-1)
- 5-6.56 Discuss the pathophysiology of bowel obstruction. (C-1)
- 5-6.57 Recognize the signs and symptoms related to bowel obstruction. (C-1)
- 5-6.58 Describe the management for bowel obstruction. (C-1)
- 5-6.59 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with bowel obstruction. (C-3)
- 5-6.60 Define Crohn's disease. (C-1)
- 5-6.61 Discuss the pathophysiology of Crohn's disease. (C-1)
- 5-6.62 Recognize the signs and symptoms related to Crohn's disease. (C-1)
- 5-6.63 Describe the management for Crohn's disease. (C-1)
- 5-6.64 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with Crohn's disease. (C-3)
- 5-6.65 Define pancreatitis. (C-1)
- 5-6.66 Discuss the pathophysiology of pancreatitis. (C-1)
- 5-6.67 Recognize the signs and symptoms related to pancreatitis. (C-1)
- 5-6.68 Describe the management for pancreatitis. (C-1)
- 5-6.69 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with pancreatitis. (C-3)
- 5-6.70 Define esophageal varices. (C-1)
- 5-6.71 Discuss the pathophysiology of esophageal varices. (C-1)
- 5-6.72 Recognize the signs and symptoms related to esophageal varices. (C-1)
- 5-6.73 Describe the management for esophageal varices. (C-1)
- 5-6.74 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with esophageal varices. (C-3)
- 5-6.75 Define hemorrhoids. (C-1)
- 5-6.76 Discuss the pathophysiology of hemorrhoids. (C-1)
- 5-6.77 Recognize the signs and symptoms related to hemorrhoids. (C-1)
- 5-6.78 Describe the management for hemorrhoids. (C-1)



- 5-6.79 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with hemorrhoids. (C-3)
- 5-6.80 Define cholecystitis. (C-1)
- 5-6.81 Discuss the pathophysiology of cholecystitis. (C-1)
- 5-6.82 Recognize the signs and symptoms related to cholecystitis. (C-1)
- 5-6.83 Describe the management for cholecystitis. (C-1)
- 5-6.84 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with cholecystitis. (C-3)
- 5-6.85 Define acute hepatitis. (C-1)
- 5-6.86 Discuss the pathophysiology of acute hepatitis. (C-1)
- 5-6.87 Recognize the signs and symptoms related to acute hepatitis. (C-1)
- 5-6.88 Describe the management for acute hepatitis. (C-1)
- 5-6.89 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with acute hepatitis. (C-3)
- 5-6.90 Integrate pathophysiological principles of the patient with a gastrointestinal emergency. (C-3)
- 5-6.91 Differentiate between gastrointestinal emergencies based on assessment findings. (C-3)
- 5-6.92 Correlate abnormal findings in the assessment with the clinical significance in the patient with abdominal pain. (C-3)
- 5-6.93 Develop a patient management plan based on field impression in the patient with abdominal pain. (C-3)

**AFFECTIVE OBJECTIVES**

None identified for this unit.

**PSYCHOMOTOR OBJECTIVES**

None identified for this unit.

**DECLARATIVE**

- I. Introduction
  - A. Epidemiology
    1. Incidence
    2. Mortality/ morbidity
    3. Risk factors
    4. Prevention strategies
  
- II. General pathophysiology, assessment and management
  - A. Pathophysiology of abdominal pain
    1. Bacterial contamination
      - a. Perforated appendix
      - b. Pelvic inflammatory disease
    2. Chemical irritation
      - a. Perforated ulcer
      - b. Pancreatitis
    3. Types of abdominal pain
      - a. Somatic pain
        - (1) Appendicitis
        - (2) Pancreatitis
        - (3) Perforated viscus
          - (a) Gallbladder
          - (b) Ulcer
          - (c) Intestine
      - b. Visceral pain
        - (1) Appendicitis
        - (2) Pancreatitis
        - (3) Cholecystitis
        - (4) Obstruction of hollow viscera
          - (a) Intestines
          - (b) Biliary tree
      - c. Referred pain
      - d. Hemorrhagic abdominal pain
      - e. Non hemorrhagic abdominal pain
    - B. Assessment findings
      1. Scene size-up
        - a. Scene safety
        - b. Personal protective equipment (PPE)
        - c. General impression
          - (1) Trauma
            - (a) Responsive
            - (b) Unresponsive
          - (2) Medical
            - (a) Responsive
            - (b) Unresponsive
      2. Initial assessment
        - a. Airway
        - b. Breathing
        - c. Circulation

- 
- d. Disability
  - e. Chief complaint
  - 3. Focused history
    - a. Onset
    - b. Provoking factors
    - c. Quality
    - d. Region/ radiation
    - e. Severity
    - f. Time
    - g. Previous history of same event
    - h. Nausea/ vomiting
    - i. Change in bowel habits/ stool
      - (1) Constipation
      - (2) Diarrhea
    - j. Weight loss
    - k. Last meal
    - l. Chest pain
  - 4. Focused physical examination
    - a. Appearance
    - b. Posture
    - c. Level of consciousness
    - d. Apparent state of health
    - e. Skin color
    - f. Vital signs
    - g. Inspect abdomen
    - h. Auscultate abdomen
    - i. Percuss abdomen
    - j. Palpate abdomen
    - k. Female abdominal exam
    - l. Male abdominal exam
  - 5. Assessment tools
    - a. Hematocrit
  - C. Management/ treatment plan
    - 1. Airway and ventilatory support
      - a. Maintain an open airway
      - b. High flow oxygen
    - 2. Circulatory support
      - a. Electrocardiogram
      - b. Monitor blood pressure
    - 3. Pharmacological interventions
      - a. Consider initiating intravenous line
      - b. Avoid intervention which mask signs and symptoms
    - 4. Non-pharmacological interventions
      - a. Nothing by mouth
      - b. Monitor LOC
      - c. Monitor vital signs
      - d. Position of comfort
    - 5. Transport consideration
      - a. Persistent pain for greater than six hours requires transport
      - b. Gentle but rapid transport

6. Psychological support
    - a. All actions reflect a calm, caring, competent attitude
    - b. Keep patient and significant others informed of your actions
- III. Specific Injuries/ illness
- A. Upper gastrointestinal bleeding
    1. Epidemiology
      - a. Incidence
      - b. Mortality/ morbidity
      - c. Risk factors
      - d. Prevention
      - e. Anatomy and physiology review
      - f. Pathophysiology
        - (1) Lesions
        - (2) Peptic ulceration
        - (3) Erosive gastritis
        - (4) Esophagogastric varices
    2. Assessment findings
      - a. History
        - (1) Acute/ chronic
        - (2) Vomiting/ hematemesis
        - (3) Stool/ melena
      - b. Physical
        - (1) Altered level of consciousness
        - (2) Skin
          - (a) Pale
          - (b) Cool
          - (c) Moist
        - (3) Inspect abdomen
          - (a) Scars
          - (b) Ecchymosis
          - (c) Contour
            - i) Bulges
            - ii) Symmetry
        - (4) Auscultate
          - (a) Bowel sounds
        - (5) Percuss
        - (6) Palpate
      - c. Assessment tools
        - (1) Hematocrit
    3. Management
      - a. Airway and ventilatory support
        - (1) High flow oxygen
      - b. Circulatory support
        - (1) Positioning
        - (2) Consider MAST
        - (3) Consider fluid bolus or resuscitation
        - (4) Consider fluid lavage
      - c. Psychological support
      - d. Transport consideration
  - B. Lower gastrointestinal bleeding

1. Epidemiology
  - a. Incidence
  - b. Mortality/ morbidity
  - c. Risk factors
  - d. Prevention strategies
  - e. Pathophysiology
    - (1) Lesions
    - (2) Anal and rectal lesions
      - (a) Hemorrhoids
      - (b) Anal fissures
      - (c) Fistulas
    - (3) Colonic lesions
      - (a) Carcinoma
      - (b) Polyps
    - (4) Diverticula
2. Assessment findings
  - a. History
    - (1) Acute/ chronic
    - (2) Vomiting/ hematemesis
    - (3) Stool/ melena
    - (4) Meal history
    - (5) Chest pain/ "gas pain"
  - b. Physical
    - (1) Altered level of consciousness
    - (2) Skin
      - (a) Pale
      - (b) Cool
      - (c) Moist
    - (3) Inspect abdomen
      - (a) Scars
      - (b) Ecchymosis
      - (c) Contour
        - i) Bulges
        - ii) Symmetry
    - (4) Auscultate
    - (5) Percuss
    - (6) Palpate
  - c. Assessment tools
    - (1) Hematocrit
3. Management
  - a. Airway and ventilatory support
    - (1) High flow oxygen
  - b. Circulatory support
    - (1) Positioning
    - (2) Consider MAST
    - (3) Consider fluid bolus or resuscitation
    - (4) Consider fluid lavage
  - c. Psychological support
  - d. Transport consideration

- C. Acute gastroenteritis
1. Epidemiology
    - a. Incidence
    - b. Mortality/ morbidity
    - c. Risk factors
    - d. Prevention strategies
    - e. Anatomy and physiology review
    - f. Pathophysiology
      - (1) Gastric mucosa
      - (2) Inflammatory process
      - (3) Pathogenesis
  2. Assessment
    - a. History
      - (1) Quality of pain
      - (2) Onset of pain
      - (3) Location of pain
      - (4) Blood in the stool
      - (5) Epigastric pain
      - (6) Nausea
      - (7) Vomiting
    - b. Physical
      - (1) Restless
      - (2) Skin
        - (a) Pale
        - (b) Cool
        - (c) Moist
      - (3) Vital Signs
        - (a) Hypotension
      - (4) Abdominal Exam
        - (a) Inspect
          - i) Contour
            - a) Bulges
            - b) Symmetry
          - (b) Auscultate
          - (c) Percuss
          - (d) Palpate
  3. Management
    - (1) Positioning
    - (2) Airway and ventilatory support
      - (a) Oxygen
    - (3) Circulatory support
      - (a) Fluid bolus
    - (4) Pharmacological interventions
    - (5) Non-pharmacological interventions
    - (6) Transport consideration
- D. Colitis
1. Epidemiology
    - a. Incidence
    - b. Morbidity/ mortality
    - c. Risk factors
    - d. Anatomy and physiology review

- e. Pathophysiology
    - (1) inflammatory bowel disease
    - (2) inflammatory action of colonic mucosa
  - 2. Assessment
    - a. History
      - (1) Quality of pain
      - (2) Onset of pain
      - (3) Location of pain
      - (4) Bloody diarrhea
      - (5) Fever
      - (6) Weight loss
    - b0 Physical
      - (1) Restless
      - (2) Skin
        - (a) Pale
        - (b) Cool
        - (c) Moist
        - (d) Warm
      - (3) Fever
      - (4) Vital signs
        - (a) Hypotension
      - (5) Abdominal exam
        - (a) Inspect
          - i Contour
          - a65535 Bulges
          - b65535 Symmetry
        - (b) Auscultate
        - (c) Percuss
          - i Dull over bladder
        - (d) Palpate
  - 3 Management
    - (1) Positioning
    - (2) Airway and ventilatory support
      - (a) Oxygen
    - (3) Circulatory support
      - (a) Fluid bolus
    - (4) Pharmacological interventions
    - (5) Non-pharmacological interventions
    - (6) Transport consideration
- E0 Gastroenteritis
- 1 Causative organisms
    - a0 Rotavirus, Norwalk virus, and many others
    - b0 Parasites
      - (1) Protozoa giardia lamblia
      - (2) Crypto sporidium parvum
      - (3) Cyclosporidium cayetensis
    - c0 Contracted via fecal-oral transmission, contaminated food and water
    - d0 Cyclosporidium reported to be contracted by swimming in contaminated waters
  - 2 Bacteria
    - a0 Escherichia coli
    - b0 Klebsiella pneumonia

- c0 Enterobacter
- d0 Campylobacter jejuni
- e0 Vibrio cholera
- f0 Shigella
  - (1) Not part of normal intestinal flora
- g0 Salmonella
  - (1) Not part of normal intestinal flora
- 3 System affected - GI system
- 4 Modes of transmission
  - a0 Fecal-oral
  - b0 Ingestion of infected food or non-potable water
- 5 Susceptibility and resistance
  - a0 Travelers into endemic areas are more susceptible
  - b0 Populations in disaster areas, where water supplies are contaminated, are susceptible
  - c0 Native populations in endemic areas are generally resistant
- 6 Signs and symptoms - nausea, vomiting, fever, abdominal pain and cramping, anorexia, lassitude, and frank shock
  - a0 Diarrhea of enteric bacteria - different clinical pictures depending on the degree of intestinal invasion
  - b0 Chronic gastritis and ulcers with abdominal pain, nausea, and "heartburn" are caused by Helicobacter pylori infection
- 7 Patient management and protective measures
  - a0 EMS personnel - do not work when ill if your job involves patient contact
  - b0 Focused on environmental health and development/ availability of clean water reservoirs, food preparation and sanitation
  - c0 Disaster workers and travelers to endemic areas must be vigilant in knowing the sources of their water supplies or drink hot beverages that have been brisk-boiled or disinfected
  - d0 Health care workers treating gastroenteritis patients must be careful to avoid habits that facilitate fecal-oral/ mucous membrane transmission, observe BSI and effective hand washing
  - e0 Selected organisms may be sensitive to antibiotics
  - f0 Epidemic treatment is normally symptomatic
- 8 Immunizations are unavailable for many of the enteric bacteria, which are part of the normal intestinal flora
- F0 Diverticulitis
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
    - f0 Pathophysiology
      - (1) Inflammation in or around the diverticula
      - (2) Retention of undigested food residue and bacteria
  - 2 Assessment
    - a0 History
      - (1) Quality of pain
      - (2) Onset of pain



- (3) Location of pain
      - (4) Dark stool
    - b0 Physical
      - (1) Altered level of consciousness
      - (2) Skin
        - (a) Pale
        - (b) Cool
        - (c) Moist
      - (3) Inspect abdomen
        - (a) Scars
        - (b) Ecchymosis
        - (c) Contour
          - i Bulges
          - ii Symmetry
      - (4) Auscultate
        - (a) Bowel sounds
      - (5) Percuss
      - (6) Palpate
    - c0 Assessment tools
      - (1) Hematocrit
  - 3 Management/ treatment plan
    - a0 Airway and ventilatory support
      - (1) Oxygen
    - b0 Circulatory support
      - (1) Positioning
      - (2) Consider fluid bolus
    - c0 Pharmacological interventions
    - d0 Non-pharmacological interventions
    - e0 Psychological support
    - f0 Transport consideration
- G0 Appendicitis
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Anatomy and physiology review
    - e0 Pathophysiology
      - (1) Obstruction appendiceal lumen
      - (2) Ulceration of appendiceal mucosa
        - (a) Viral
        - (b) Bacterial
  - 2 Assessment findings
    - a0 History
      - (1) Quality of pain
      - (2) Onset of pain
      - (3) Location of pain
      - (4) Anorexia
      - (5) Nausea/ vomiting
    - b0 Physical
      - (1) Skin

- (a) Pale
- (b) Cool
- (c) Moist
- (d) Warm
- (2) Fever
- (3) Inspect abdomen
  - (a) Scars
  - (b) Ecchymosis
  - (c) Contour
    - i Bulges
    - ii Symmetry
- (4) Auscultate
  - (a) Bowel sounds
- (5) Percuss
- (6) Palpate
- 3 Management/ treatment plan
  - a0 Airway and ventilatory support
    - (1) Oxygen
  - b0 Circulatory support
    - (1) Positioning
    - (2) Consider fluid bolus
  - c0 Pharmacological interventions
  - d0 Non-pharmacological interventions
  - e0 Psychological support
  - f0 Transport consideration
- H0 Peptic ulcer disease
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
    - f0 Pathophysiology
      - (1) Ulcerative disorder
      - (2) Acid-pepsin formation
      - (3) Loss of protective effects
        - (a) Gastric mucosa
        - (b) Bicarbonate ions
        - (c) Prostaglandins
  - 2 Assessment findings
    - a0 History
      - (1) Acute/ chronic
      - (2) Quality of pain
      - (3) Onset of pain
      - (4) Location of pain
      - (5) Last meal
      - (6) Nausea
      - (7) Stool/ melena
      - (8) Vomiting/ hematemesis
    - b0 Physical
      - (1) Altered level of consciousness

- (2) Cardiovascular
        - (a) Hypotension
        - (b) Tachycardia
      - (3) Skin
        - (a) Pale
        - (b) Cool
        - (c) Moist
      - (4) Inspect abdomen
        - (a) Scars
        - (b) Ecchymosis
        - (c) Contour
          - i Bulges
          - ii Symmetry
      - (5) Auscultate
        - (a) Bowel sounds
      - (6) Percuss
      - (7) Palpate
    - c0 Assessment tools
      - (1) Hematocrit
  - 3 Management
    - a0 Airway and ventilatory support
      - (1) High flow oxygen
    - b0 Circulatory support
      - (1) Positioning
      - (2) Consider fluid bolus or resuscitation
    - c0 Pharmacological
      - (1) Antacid
      - (2) H<sub>2</sub> Blockers
    - d0 Psychological support
    - e0 Transport consideration
- 10 Bowel obstruction
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Anatomy and physiology review
    - e0 Pathophysiology
      - (1) Mechanical
      - (2) Non-mechanical
      - (3) Lesions
      - (4) Obturation of the lumen
      - (5) Small/ large bowel
      - (6) Adhesions
      - (7) Hernias
  - 2 Assessment findings
    - a0 History
      - (1) Acute/ chronic
      - (2) Quality of pain/ paroxysms
      - (3) Onset of pain
      - (4) Location of pain
      - (5) Nausea

- (6) Vomiting/ odor/ bile
        - (7) Stool/ diarrhea/ unable
      - b0 Physical
        - (1) Altered level of consciousness
        - (2) Cardiovascular
          - (a) Hypotension
          - (b) Tachycardia
        - (3) Skin
          - (a) Pale
          - (b) Cool
          - (c) Moist
        - (4) Inspect abdomen
          - (a) Scars
          - (b) Ecchymosis
          - (c) Contour
            - i Bulges
            - ii Symmetry
        - (5) Auscultate
          - (a) Bowel sounds/ absent
        - (6) Percuss
        - (7) Palpate
    - 3 Management
      - a0 Airway and ventilatory support
        - (1) High flow oxygen
      - b0 Circulatory support
        - (1) Positioning
        - (2) Consider fluid bolus or resuscitation
      - c0 Psychological support
      - d0 Transport consideration
- J0 Crohn's disease
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
      - (1) Positive family history same disorder
      - (2) Stress
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
    - f0 Pathophysiology
      - (1) Inflammatory disorder
        - (a) Small bowel
        - (b) Large bowel
      - (2) Increased suppressor T-cell activity
      - (3) Intestinal submucosa
      - (4) Lesions
      - (5) Fistulas
  - 2 Assessment findings
    - a0 History
      - (1) Acute/ chronic
      - (2) Quality of pain
      - (3) Onset of pain

- (4) Location of pain
      - (5) "Irritable bowel"
      - (6) Stool/ diarrhea
      - (7) Weight loss
    - b0 Physical
      - (1) Skin
        - (a) Pale
        - (b) Cool
        - (c) Moist
      - (2) Inspect abdomen
        - (a) Scars
        - (b) Ecchymosis
        - (c) Contour
          - i Bulges
          - ii Symmetry
      - (3) Auscultate
        - (a) Bowel sounds
      - (4) Percuss
      - (5) Palpate
  - 3 Management
    - a0 Airway and ventilatory support
      - (1) High flow oxygen
    - b0 Circulatory support
      - (1) Positioning
    - c0 Psychological support
    - d0 Transport consideration
- K0 Pancreatitis
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
      - (1) Gallstones
      - (2) Alcohol
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
  - 2 Pathophysiology
    - a0 Inflammation
    - b0 Injury or disruption of pancreatic ducts or acini
    - c0 Leaked enzymes
  - 3 Assessment findings
    - a0 History
      - (1) Acute/ chronic
      - (2) Quality of pain
      - (3) Onset of pain
      - (4) Location of pain
      - (5) Nausea/ vomiting
    - b0 Physical
      - (1) Cardiovascular
        - (a) Hypotension
        - (b) Tachycardia

- (2) Lungs
    - (a) Pulmonary edema
  - (3) Skin
    - (a) Pale
    - (b) Cool
    - (c) Moist
  - (4) Edema
  - (5) Inspect abdomen
    - (a) Scars
    - (b) Ecchymosis
    - (c) Contour
      - i Bulges
      - ii Symmetry
  - (6) Auscultate
    - (a) Bowel sounds
  - (7) Percuss
  - (8) Palpate
- 4 Management
- a0 Airway and ventilatory support
    - (1) High flow oxygen
  - b0 Circulatory support
    - (1) Positioning
    - (2) Fluid bolus
  - c0 Psychological support
  - d0 Transport considerations
- L0 Esophageal varices
- 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
    - f0 Pathophysiology
      - (1) Portal hypertension
      - (2) Esophagitis with erosion
      - (3) Ingestion caustic substance
  - 2 Assessment findings
    - a0 History
      - (1) Acute
      - (2) Painless
      - (3) Nausea
      - (4) Vomiting/ hematemesis
    - b0 Physical
      - (1) Cardiovascular
        - (a) Hypotension
        - (b) Tachycardia
      - (2) Skin
        - (a) Pale
        - (b) Cool
        - (c) Moist

3. Management
    - a. Airway and ventilatory support
      - (1 High flow oxygen
      - (2 Suction
    - b. Circulatory support
      - (1 Positioning
      - (2 Fluid bolus or resuscitation
    - c. Transport consideration
- M. Hemorrhoids
1. Epidemiology
    - a. Incidence
    - b. Mortality/ morbidity
    - c. Risk factors
    - d. Prevention strategies
    - e. Anatomy and physiology review
    - f. Pathophysiology
      - (1 Internal/ external hemorrhoid
      - (2 Increased portal vein pressure
      - (3 Mucosal surface
        - (a Thrombosis
        - (b Infection
        - (c Erosion
  2. Assessment findings
    - a. History
      - (1 Rectal pain
      - (2 Increased pain with bowel movement
      - (3 Stool/ blood
    - b. Physical
  3. Management
    - a. Psychological support
    - b. Transport consideration
- N. Cholecystitis
1. Epidemiology
    - a. Incidence
    - b. Mortality/ morbidity
    - c. Risk factors
    - d. Prevention strategies
    - e. Anatomy and physiology review
    - f. Pathophysiology
      - (1 Gallstones in cystic duct
  2. Assessment findings
    - a. History
      - (1 Acute/ chronic
      - (2 Quality of pain
      - (3 Onset of pain
      - (4 Location of pain
    - b. Physical
      - (1 Skin
        - (a Pale
        - (b Cool

- (c) Moist
        - (d) Warm
      - (2) Fever
      - (3) Inspect abdomen
        - (a) Scars
        - (b) Ecchymosis
        - (c) Contour
          - i) Bulges
          - ii) Symmetry
      - (4) Auscultate
        - (a) Bowel sounds
      - (5) Percuss
      - (6) Palpate
    - 3. Management/ treatment plan
      - a. Pharmacological interventions
        - (1) Consider pain medication
      - b. Transport consideration
- O. Acute hepatitis
  - 1. Epidemiology
    - a. Incidence
    - b. Mortality/ morbidity
    - c. Risk factors
    - d. Prevention strategies
    - e. Anatomy and physiology review
    - f. Pathophysiology
      - (1) Systemic infection of the liver
      - (2) Types
      - (3) Chronic liver disease
      - (4) Cirrhosis
      - (5) Pathogenesis
  - 2. Assessment findings
    - a. History
      - (1) Acute/ chronic onset
      - (2) Quality of abdominal pain
      - (3) Location of pain
      - (4) Anorexia
      - (5) Nausea
      - (6) Vomiting
      - (7) Fatigue
      - (8) Headache
      - (9) Malaise
      - (10) Photophobia
      - (11) Pharyngitis
      - (12) Cough
    - b. Physical
      - (1) Skin
        - (a) Warm
        - (b) Rash
      - (2) Fever
      - (3) Inspect abdomen



- (a) Scars
  - (b) Ecchymosis
  - (c) Contour
    - i) Bulges
    - ii) Symmetry
  - (4) Auscultate
    - (a) Bowel sounds
  - (5) Percuss
  - (6) Palpate
3. Management
- a. Psychological support
  - b. Transport consideration
- . Integration

### **UNIT TERMINAL OBJECTIVE**

- 5-7 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with a renal or urologic problem.

### **COGNITIVE OBJECTIVES**

At the conclusion of this unit, the paramedic student will be able to :

- 5-7.1 Describe the incidence, morbidity, mortality, and risk factors predisposing to urological emergencies. (C-1)
- 5-7.2 Discuss the anatomy and physiology of the organs and structures related to urogenital diseases. (C-1)
- 5-7.3 Define referred pain and visceral pain as it relates to urology. (C-1)
- 5-7.4 Describe the questioning technique and specific questions the paramedic should utilize when gathering a focused history in a patient with abdominal pain. (C-1)
- 5-7.5 Describe the technique for performing a comprehensive physical examination of a patient complaining of abdominal pain. (C-1)
- 5-7.6 Define acute renal failure. (C-1)
- 5-7.7 Discuss the pathophysiology of acute renal failure. (C-1)
- 5-7.8 Recognize the signs and symptoms related to acute renal failure. (C-1)
- 5-7.9 Describe the management for acute renal failure. (C-1)
- 5-7.10 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with acute renal failure. (C-3)
- 5-7.11 Define chronic renal failure. (C-1)
- 5-7.12 Discuss the pathophysiology of chronic renal failure. (C-1)
- 5-7.13 Recognize the signs and symptoms related to chronic renal failure. (C-1)
- 5-7.14 Describe the management for chronic renal failure. (C-1)
- 5-7.15 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with chronic renal failure. (C-3)
- 5-7.16 Define renal dialysis. (C-1)
- 5-7.17 Discuss the common complication of renal dialysis. (C-1)
- 5-7.18 Define renal calculi. (C-1)
- 5-7.19 Discuss the pathophysiology of renal calculi. (C-1)
- 5-7.20 Recognize the signs and symptoms related to renal calculi. (C-1)
- 5-7.21 Describe the management for renal calculi. (C-1)
- 5-7.22 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with renal calculi. (C-3)
- 5-7.23 Define urinary tract infection. (C-1)
- 5-7.24 Discuss the pathophysiology of urinary tract infection. (C-1)
- 5-7.25 Recognize the signs and symptoms related to urinary tract infection. (C-1)
- 5-7.26 Describe the management for a urinary tract infection. (C-1)
- 5-7.27 Integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with a urinary tract infection. (C-3)
- 5-7.28 Apply the epidemiology to develop prevention strategies for urological emergencies. (C-2)
- 5-7.29 Integrate pathophysiological principles to the assessment of a patient with abdominal pain. (C-3)
- 5-7.30 Synthesize assessment findings and patient history information to accurately differentiate between pain of a urogenital emergency and that of other origins. (C-3)
- 5-7.31 Develop, execute, and evaluate a treatment plan based on the field impression made in the assessment. (C-3)

**AFFECTIVE OBJECTIVES**

None identified for this unit.

**PSYCHOMOTOR OBJECTIVES**

None identified for this unit.

## DECLARATIVE

- I. Introduction
  - A. Epidemiology
    - 1. Incidence
    - 2. Mortality/ morbidity
    - 3. Risk factors
    - 4. Prevention strategies
  - B. Anatomy and physiology review
  - C. Mechanisms of injuries/ illness
  
- II. General pathophysiology, assessment and management
  - A. Pathophysiology of abdominal pain
    - 1. Bacterial contamination
      - a. Urinary tract infection
    - 2. Types of abdominal pain
      - a. Visceral pain
        - (1) Obstruction of hollow viscera (ureters, urethra, etc.)
      - b. Referred pain
  - B. Assessment findings
    - 1. Scene size-up
    - 2. Initial assessment
      - a. Airway
      - b. Breathing
      - c. Circulation
      - d. Disability
      - e. Chief complaint
    - 3. Focused history
      - a. Onset
      - b. Provoking factors
      - c. Quality
      - d. Region/ radiation
      - e. Severity
      - f. Time
      - g. Previous history of same event
      - h. Nausea / vomiting
      - i. Change in bowel habits/ stool
        - (1) Constipation
        - (2) Diarrhea
      - j. Weight loss
      - k. Last meal
      - l. Chest pain
    - 4. Focused physical examination
      - a. Appearance
      - b. Posture
      - c. Level of consciousness
      - d. Apparent state of health
      - e. Skin color
      - f. Vital signs
      - g. Inspect abdomen
      - h. Auscultate abdomen

- i. Percuss abdomen
      - j. Palpate abdomen
      - k. Female abdominal exam
      - l. Male abdominal exam
    - 5. Assessment tools
      - a. Hematocrit
  - C. Management/ treatment plan
    - 1. Airway and ventilatory support
      - a. Maintain an open airway
      - b. High flow oxygen
    - 2. Circulatory support
      - a. Electrocardiogram
      - b. Monitor blood pressure
    - 3. Pharmacological interventions
      - a. Consider initiating intravenous line
      - b. Avoid intervention which mask signs and symptoms
    - 4. Non-pharmacological interventions
      - a. Nothing by mouth
      - b. Monitor LOC
      - c. Monitor vital signs
      - d. Position of comfort
    - 5. Transport consideration
      - a. Persistent pain for greater than six hours requires transport
      - b. Gentle but rapid transport
    - 6. Psychological support
      - a. All actions reflect a calm, caring, competent attitude
      - b. Keep patient and significant others informed of your actions
- III. Specific injuries/ illness
  - A. Acute renal failure
    - 1. Epidemiology
      - a. Incidence
      - b. Mortality/ morbidity
        - (1) Overall mortality 50%
      - c. Risk factors
        - (1) Prerenal
        - (2) Postrenal
        - (3) Renal
      - d. Prevention strategies
        - (1) Protection of cardiovascular function and volume
        - (2) Reduce exposure to nephrotoxic drugs
      - e. Anatomy and physiology review
      - f. Pathophysiology
        - (1) Function of the nephron and glomerular filtration rate
        - (2) Retention of nitrogenous waste products and electrolytes
        - (3) Aberrations in glucose reabsorption
        - (4) Disorders of renal hypoperfusion
          - (a) Hypovolemia
          - (b) Low cardiac output
          - (c) Increased renal systemic vascular resistance ratio

- (d) Diseases of renal parenchyma
    - i) Renovascular obstruction
    - ii) Glomerular renal microvasculature
    - iii) Acute tubular necrosis
    - iv) Interstitial nephritis
  - (e) Acute obstruction of the urinary tract
    - i) Ureter
    - ii) Bladder neck
    - iii) Urethra
  - (f) Hyperkalemia
  - (g) Metabolic acidosis
2. Assessment findings
- a. History
    - (1) Oliguria/ anuria
    - (2) Edema
    - (3) Acidosis
  - b. Physical
    - (1) Altered level of consciousness
    - (2) Skin
      - (a) Pale
      - (b) Cool
      - (c) Moist
    - (3) Cardiovascular
      - (a) Hypotension
      - (b) Tachycardia
      - (c) ECG findings
    - (4) Inspect abdomen
      - (a) Scars
      - (b) Ecchymosis
      - (c) Contour
        - i) Bulges
        - ii) Symmetry
    - (5) Auscultate
    - (6) Palpate
  - c. Assessment tools
    - (1) Hematocrit
    - (2) Urinalysis
3. Management
- a. Airway and ventilatory support
    - (1) High flow oxygen
  - b. Circulatory support
    - (1) Positioning
    - (2) Consider fluid bolus or resuscitation
    - (3) Consider fluid lavage
  - c. Psychological support
  - d. Transport consideration
- B. Chronic renal failure
- 1. Epidemiology
    - a. Incidence
    - b. Mortality/ morbidity
    - c. Risk factors

- (1) Diabetes mellitus
- (2) Hypertension
- d. Prevention strategies
- e. Anatomy and physiology review
- f. Pathophysiology
  - (1) Reduction of renal mass
  - (2) Reduction of nephron mass
  - (3) Glucose intolerance
  - (4) Electrolyte imbalance
  - (5) Anemia
- 2. Assessment findings
  - a. History
    - (1) Anorexia
    - (2) Nausea
    - (3) Vomiting
    - (4) Anxiety
    - (5) Seizure activity
  - b. Physical
    - (1) Altered level of consciousness
      - (a) Delirium
    - (2) Skin
      - (a) Pale
      - (b) Cool
      - (c) Moist
      - (d) Jaundice
      - (e) Uremic frost
    - (3) Cardiovascular
      - (a) Hypotension
      - (b) Tachycardia
      - (c) ECG findings
      - (d) Pericarditis rub
      - (e) Edema
    - (4) Lungs
      - (a) Pulmonary edema
    - (5) Neurological
      - (a) Seizure
      - (b) Muscle twitching
    - (6) Inspect abdomen
      - (a) Scars
      - (b) Ecchymosis
      - (c) Contour
      - (d) Bulges
    - (7) Symmetry
    - (8) Auscultate
    - (9) Percuss
    - (10) Palpate
  - c. Assessment tools
    - (1) Hematocrit
    - (2) Urinalysis

- 3. Management
  - a. Airway and ventilatory support
    - (1) High flow oxygen
  - b. Circulatory support
    - (1) Positioning
    - (2) Consider fluid bolus or resuscitation
    - (3) Consider fluid lavage
  - c. Pharmacological
    - (1) Vasopressor
  - d. Non-pharmacological
    - (1) Renal dialysis
      - (a) Definition
        - i) Process of diffusing blood across a semi-permeable membrane to remove substances that normally the kidney would eliminate
        - ii) May restore electrolyte and acid base imbalances
      - (b) Complications
        - i) Vascular-access related - most common
          - a) Bleeding from dialysis puncture site
          - b) Thrill in access has been lost
          - c) Infection
        - ii) Non-vascular access related
          - a) Hypotension
          - b) Shortness of breath
          - c) Chest pain
          - d) Neurologic abnormalities
  - e. Psychological support
  - f. Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
- C. Renal calculi
  - 1. Epidemiology
    - a. Incidence
    - b. Mortality/ morbidity
    - c. Risk factors
      - (1) Absent sensory/ motor impulses
      - (2) Medications
        - (a) Anesthetics
        - (b) Opiates
        - (c) Psychotropic
      - (3) Postoperative
    - d. Prevention strategies
    - e. Anatomy and physiology review
    - f. Pathophysiology
      - (1) Urinary stones
        - (a) Calcium salts
        - (b) Uric acid
        - (c) Cystine
        - (d) Struvite



- 2. Assessment findings
  - a. History
    - (1) Quality of pain
    - (2) Onset of pain
    - (3) Location of pain
    - (4) Dysuria
    - (5) Hematuria
    - (6) Nocturia
    - (7) Frequent urination
    - (8) History of same condition
  - b. Physical
    - (1) Restless
    - (2) Skin
      - (a) Pale
      - (b) Cool
      - (c) Moist
    - (3) Vital signs
      - (a) Vary considerably
    - (4) Abdominal exam
      - (a) Inspect
        - i) Contour
          - a) Bulges
          - b) Symmetry
      - (b) Auscultate
      - (c) Palpate
- 3. Management
  - a. Airway and ventilatory support
  - b. Circulatory support
    - (1) Positioning
  - c. Pharmacological
    - (1) Consider pain management
  - d. Non-pharmacological
    - (1) Pain management
  - e. Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
- D. Urinary tract infection
  - 1 Epidemiology
    - a0 Incidence
    - b0 Mortality/ morbidity
    - c0 Risk factors
      - (1) Nerve disruption
      - (2) Diabetes
    - d0 Prevention strategies
    - e0 Anatomy and physiology review
    - f0 Pathophysiology
      - (1) Lower tract infection
        - (a) Urethritis
        - (b) Cystitis
        - (c) Prostatitis

- (2) Upper tract infection
    - (a) Pyelonephritis
    - (b) Intrarenal and perinephric abscesses
  - (3) Pathogenic microorganisms
- 2 Assessment findings
- a0 History
    - (1) Quality of pain
    - (2) Onset of pain
    - (3) Location of pain
    - (4) Dysuria
    - (5) Urgency to urinate
    - (6) Strong urine odor
    - (7) History of same condition
  - b0 Physical
    - (1) Restless
    - (2) Skin
      - (a) Pale
      - (b) Cool
      - (c) Moist
      - (d) Warm
    - (3) Fever
    - (4) Vital signs
      - (a) Vary considerably
    - (5) Abdominal exam
      - (a) Inspect
        - i Contour
          - a65535 Bulges
          - b65535 Symmetry
      - (b) Auscultate
      - (c) Palpate
- 3 Management
- a0 Airway and ventilatory support
  - b0 Circulatory support
    - (1) Positioning
  - c0 Pharmacological
    - (1) Consider pain management
  - d0 Non-pharmacological
    - (1) Pain management
  - e0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility

Integration

### **UNIT TERMINAL OBJECTIVE**

- 5-8 At the completion of this unit, the paramedic student will be able to integrate pathophysiological principles and assessment findings to formulate a field impression and implement a treatment plan for the patient with a toxic exposure.

### **COGNITIVE OBJECTIVES**

At the completion of this unit, the paramedic student will be able to:

- 5-8.1 Describe the incidence, morbidity and mortality of toxic emergencies. (C-1)
- 5-8.2 Identify the risk factors most predisposing to toxic emergencies. (C-1)
- 5-8.3 Discuss the anatomy and physiology of the organs and structures related to toxic emergencies. (C-1)
- 5-8.4 Describe the routes of entry of toxic substances into the body. (C-1)
- 5-8.5 Discuss the role of the Poison Control Center in the United States. (C-1)
- 5-8.6 List the toxic substances that are specific to your region. (C-1)
- 5-8.7 Discuss the pathophysiology of the entry of toxic substances into the body. (C-1)
- 5-8.8 Discuss the assessment findings associated with various toxidromes. (C-1)
- 5-8.9 Identify the need for rapid intervention and transport of the patient with a toxic substance emergency. (C-1)
- 5-8.10 Discuss the management of toxic substances. (C-1)
- 5-8.11 Define poisoning by ingestion. (C-1)
- 5-8.12 List the most common poisonings by ingestion. (C-1)
- 5-8.13 Describe the pathophysiology of poisoning by ingestion. (C-1)
- 5-8.14 Recognize the signs and symptoms related to the most common poisonings by ingestion. (C-1)
- 5-8.15 Correlate the abnormal findings in assessment with the clinical significance in the patient with the most common poisonings by ingestion. (C-1)
- 5-8.16 Differentiate among the various treatments and pharmacological interventions in the management of the most common poisonings by ingestion. (C-3)
- 5-8.17 Discuss the factors affecting the decision to induce vomiting in a patient with ingested poison. (C-1)
- 5-8.18 Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with the most common poisonings by ingestion. (C-3)
- 5-8.19 Define poisoning by inhalation. (C-1)
- 5-8.20 List the most common poisonings by inhalation. (C-1)
- 5-8.21 Describe the pathophysiology of poisoning by inhalation. (C-1)
- 5-8.22 Recognize the signs and symptoms related to the most common poisonings by inhalation. (C-1)
- 5-8.23 Correlate the abnormal findings in assessment with the clinical significance in patients with the most common poisonings by inhalation. (C-1)
- 5-8.24 Differentiate among the various treatments and pharmacological interventions in the management of the most common poisonings by inhalation. (C-3)
- 5-8.25 Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with the most common poisonings by inhalation. (C-3)
- 5-8.26 Define poisoning by injection. (C-1)
- 5-8.27 List the most common poisonings by injection. (C-1)
- 5-8.28 Describe the pathophysiology of poisoning by injection. (C-1)
- 5-8.29 Recognize the signs and symptoms related to the most common poisonings by injection. (C-1)
- 5-8.30 Correlate the abnormal findings in assessment with the clinical significance in the patient with the most common poisonings by injection. (C-3)
- 5-8.31 Differentiate among the various treatments and pharmacological interventions in the management of the most common poisonings by injection. (C-3)
- 5-8.32 Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for the patient with the most common poisonings by injection. (C-3)
- 5-8.33 Define poisoning by surface absorption. (C-1)

- 5-8.34 List the most common poisonings by surface absorption. (C-1)
- 5-8.35 Describe the pathophysiology of poisoning by surface absorption. (C-1)
- 5-8.36 Recognize the signs and symptoms related to the most common poisonings by surface absorption. (C-1)
- 5-8.37 Correlate the abnormal findings in assessment with the clinical significance in patients with the most common poisonings by surface absorption. (C-3)
- 5-8.38 Differentiate among the various treatments and pharmacological interventions in the management of the most common poisonings by surface absorption. (C-3)
- 5-8.39 Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for patients with the most common poisonings by surface absorption. (C-3)
- 5-8.40 Define poisoning by overdose. (C-1)
- 5-8.41 List the most common poisonings by overdose. (C-1)
- 5-8.42 Describe the pathophysiology of poisoning by overdose. (C-1)
- 5-8.43 Recognize the signs and symptoms related to the most common poisonings by overdose. (C-1)
- 5-8.44 Correlate the abnormal findings in assessment with the clinical significance in patients with the most common poisonings by overdose. (C-3)
- 5-8.45 Differentiate among the various treatments and pharmacological interventions in the management of the most common poisonings by overdose. (C-3)
- 5-8.46 Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for patients with the most common poisonings by overdose. (C-3)
- 5-8.47 Define drug abuse. (C-1)
- 5-8.48 Discuss the incidence of drug abuse in the United States. (C-1)
- 5-8.49 Define the following terms: (C-1)
  - a. Substance or drug abuse
  - b. Substance or drug dependence
  - c. Tolerance
  - d. Withdrawal
  - e. Addiction
- 5-8.50 List the most commonly abused drugs (both by chemical name and street names). (C-1)
- 5-8.51 Describe the pathophysiology of commonly used drugs. (C-1)
- 5-8.52 Recognize the signs and symptoms related to the most commonly abused drugs. (C-1)
- 5-8.53 Correlate the abnormal findings in assessment with the clinical significance in patients using the most commonly abused drugs. (C-3)
- 5-8.54 Differentiate among the various treatments and pharmacological interventions in the management of the most commonly abused drugs. (C-3)
- 5-8.55 Integrate pathophysiological principles and the assessment findings to formulate a field impression and implement a treatment plan for patients using the most commonly abused drugs. (C-3)
- 5-8.56 List the clinical uses, street names, pharmacology, assessment finding and management for patient who have taken the following drugs or been exposed to the following substances: (C-1)
  - 1. Cocaine
  - 2. Marijuana and cannabis compounds
  - 3. Amphetamines and amphetamine-like drugs
  - 4. Barbiturates
  - 5. Sedative-hypnotics
  - 6. Cyanide
  - 7. Narcotics/ opiates
  - 8. Cardiac medications
  - 9. Caustics
  - 10. Common household substances

11. Drugs abused for sexual purposes/ sexual gratification
  12. Carbon monoxide
  13. Alcohols
  14. Hydrocarbons
  15. Psychiatric medications
  16. Newer anti-depressants and serotonin syndromes
  17. Lithium
  18. MAO inhibitors
  19. Non-prescription pain medications
    - (1) Nonsteroidal anitnflammatory agents
    - (2) Salicylates
    - (3) Acetaminophen
  20. Theophylline
  21. Metals
  22. Plants and mushrooms
- 5-8.57 Discuss common causative agents, pharmacology, assessment findings and management for a patient with food poisoning. (C-1)
- 5-8.58 Discuss common offending organisms, pharmacology, assessment findings and management for a patient with a bite or sting. (C-1)
- 5-8.59 Integrate pathophysiological principles of the patient with a toxic substance exposure. (C-1)
- 5-8.60 Differentiate between toxic substance emergencies based on assessment findings. (C-3)
- 5-8.61 Correlate abnormal findings in the assessment with the clinical significance in the patient exposed to a toxic substance. (C-3)
- 5-8.62 Develop a patient management plan based on field impression in the patient exposed to a toxic substance. (C-3)

### **AFFECTIVE OBJECTIVES**

None identified for this unit.

### **PSYCHOMOTOR OBJECTIVES**

None identified for this unit.

## DECLARATIVE

- I. General toxicology, assessment and management
  - A. Types of toxicological emergencies
    - 1. Unintentional poisoning
      - a. Dosage errors
      - b. Idiosyncratic reactions
      - c. Childhood poisoning
      - d. Environmental exposure
      - e. Occupational exposures
      - f. Neglect and Abuse
    - 2. Drug/ alcohol abuse
    - 3. Intentional poisoning/ overdose
      - a. Chemical warfare
      - b. Assault/ homicide
      - c. Suicide attempts
  - B. Use of poison control centers
  - C. Routes of absorption
    - 1. Ingestion
    - 2. Inhalation
    - 3. Injection
    - 4. Absorption
  - D. Poisoning by ingestion
    - 1. Examples
    - 2. Anatomy and physiology review
      - a. Absorption
      - b. Distribution
    - 3. Assessment findings
    - 4. General management considerations
  - E. Poisoning by inhalation
    - 1. Examples
    - 2. Anatomy and physiology review
      - a. Absorption
      - b. Distribution
    - 3. Assessment findings
    - 4. General management considerations
  - F. Poisoning by injection
    - 1. Examples
      - a. IV drug abuse
      - b. Venomous bites and stings
    - 2. Anatomy and physiology review
      - a. Absorption

- b. Distribution
    - 3. Assessment findings
    - 4. General management considerations
  - G. Poisoning by absorption
    - 1. Examples
    - 2. Anatomy and physiology review
      - a. Absorption
      - b. Distribution
    - 3. Assessment findings
    - 4. General management considerations
  - H. Drugs abuse
    - 1. Epidemiology
      - a. Incidence
      - b. Morbidity/ mortality
      - c. Risk factors
      - d. Prevention
    - 2. Psychological issues
    - 3. Psycho-social issues
    - 4. Pathophysiology of long term drug abuse
      - a. End organ damage
        - (1) Brain
        - (2) Liver
        - (3) Heart
      - b. Malnutrition
    - 5. Basic concepts
      - a. Habituation/ dependence/ addiction
        - (1) Physical
        - (2) Psychological
      - b. Tolerance
      - c. Antagonist
      - d. Potentiating
      - e. Synergism
      - f. Withdrawal syndromes
    - 6. Assessment finding
  - I. Alcoholism
    - 1. Epidemiology
      - a. Incidence
      - b. Morbidity/ mortality
      - c. Risk factors
      - d. Prevention
    - 2. Psychological issues
    - 3. Psycho-social issues

4. Pathophysiology of long term alcohol abuse
    - a. End organ damage
      - (1) Brain
      - (2) Liver
      - (3) Heart
      - (4) Bone
      - (5) Pancreas
    - b. Malnutrition
    - c. Withdrawal syndrome
  5. Assessment findings
- J. Toxic syndromes
1. Definition/ advantages
    - a. Grouping of toxicologically similar agents
    - b. Useful for remembering the assessment and management of toxicological emergencies
    - c. Does not consider how or why the toxin has been introduced to the body
    - d. Be sure to include the general management based on route of entry in addition to specific treatments
  2. Cholinergics
    - a. Common causative agents - pesticides (organophosphates, carbamates) and nerve agents (sarin, Soman)
    - b. Assessment findings
      - (1) Headache
      - (2) Dizziness
      - (3) Weakness
      - (4) Nausea
      - (5) SLUDGE (salivation, lacrimation, urination, defecation, GI Upset, Emesis)
      - (6) Bradycardia, wheezing, bronchoconstriction, myosis, coma, convulsions
      - (7) Diaphoresis, seizures
    - c. Management
      - (1) Decontamination
      - (2) Airway and ventilation
        - (a) Aggressive airway management
      - (3) Circulation
      - (4) Pharmacological
        - (a) Atropine
        - (b) Pralidoxime chloride (2-PAM)



- (c) Diazepam
    - (d) Activated charcoal
  - (5) Non-pharmacological
  - (6) Transport considerations
    - (a) Appropriate mode
    - (b) Appropriate facility
  - (7) Psychological/ communication strategies
- 3. Anticholinergic
  - a. Common causative agents
  - b. Assessment findings
  - c. Management
    - (1) Airway and ventilation
    - (2) Circulation
    - (3) Pharmacological
    - (4) Non-pharmacological
    - (5) Transport considerations
      - (a) Appropriate mode
      - (b) Appropriate facility
    - (6) Psychological/communication strategies
- 4. Hallucinogens
  - a. Common causative agents - lysergic acid diethylamide (LSD), phenyclicidine (PCP), peyote, mushrooms, jimson weed, mescaline
  - b. Assessment findings
    - (1) Chest pain
  - c. Management
    - (1) Airway and ventilation
    - (2) Circulation
    - (3) Pharmacological
    - (4) Non-pharmacological
    - (5) Transport considerations
      - (a) Appropriate mode
      - (b) Appropriate facility
    - (6) Psychological/ communication strategies
- 5. Narcotics/ opiates
  - a. Common causative agents - heroin, morphine, codeine, meperidine, propoxyphene, fentanyl
  - b. Assessment findings
    - (1) Euphoria
    - (2) Hypotension
    - (3) Respiratory depression/ arrest
    - (4) Nausea

- (5) Pinpoint pupils
  - (6) Seizures
  - (7) Coma
  - c. Management
    - (1) Airway and ventilation
    - (2) Circulation
    - (3) Pharmacological
      - (a) Naloxone- opiate specific antidotal therapy
    - (4) Non-pharmacological
    - (5) Transport considerations
      - (a) Appropriate mode
      - (b) Appropriate facility
    - (6) Psychological/ communication strategies
  - 6. Sympathomimetics
    - a. Common causative agents
    - b. Assessment findings
    - c. Management
      - (1) Airway and ventilation
      - (2) Circulation
      - (3) Pharmacological
      - (4) Non-pharmacological
      - (5) Transport considerations
        - (a) Appropriate mode
        - (b) Appropriate facility
      - (6) Psychological/ communication strategies
- II. Specific toxicology, assessment and management
- A. Cocaine
    - 1. Clinical uses
    - 2. Common causative agents
    - 3. Common street names
    - 4. Pharmacodynamics
    - 5. Pharmacokinetics
    - 6. Assessment findings
    - 7. Management
      - a. Airway and ventilation
      - b. Circulation
      - c. Pharmacological
      - d. Non-pharmacological
      - e. Transport considerations
        - (1) Appropriate mode
        - (2) Appropriate facility

- f. Psychological/ communication strategies
- B. Marijuana and cannabis compounds
  - 1. Clinical uses
  - 2. Common causative agents
  - 3. Common street names
  - 4. Pharmacodynamics
  - 5. Pharmacokinetics
  - 6. Assessment findings
  - 7. Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/ communication strategies
- C0 Amphetamines and amphetamine-like drugs
  - 1. Clinical uses
  - 2. Common causative agents
  - 3. Common street names
  - 4. Pharmacodynamics
  - 5. Pharmacokinetics
  - 6. Assessment findings
  - 7. Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/communication strategies
- D0 Barbiturates
  - 1. Clinical uses
  - 2. Common causative agents
  - 3. Common street names
  - 4. Pharmacodynamics
  - 5. Pharmacokinetics
  - 6. Assessment findings
  - 7. Management
    - a0 Airway and ventilation

- b0 Circulation
  - c0 Pharmacological
  - d0 Non-pharmacological
  - e0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
  - f0 Psychological/ communication strategies
- E0 Sedative-hypnotics
- 1 Clinical use
  - 2 Common causative agents - benzodiazepines (diazepam, chlordiazepoxide, midazolam)
  - 3 Common street names
  - 4 Pharmacodynamics
  - 5 Pharmacokinetics
  - 6 Assessment findings
    - a0 Respiratory depression/ respiratory arrest
    - b0 Hypotension
  - 7 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
      - (1) Antidote
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/ communication strategies
- F0 Cyanide
- 1 Sources
  - 2 Common causative agents
    - a0 Used in industry (electroplating, ore extraction, fumigation of structures)
    - b0 Product of combustion of nylon or polyurethane
    - c0 Ingestion of seeds (apricot, cherry, pears)
    - d0 Nitroprusside administration
  - 3 Pharmacodynamics
  - 4 Pharmacokinetics
  - 5 Assessment findings
    - a0 History of cyanide exposure
    - b0 Early findings (anxiety, dyspnea, confusion, hypertension, agitation)

- c0 Late findings (hypotension, acidosis , seizures, pulmonary edema, dysrhythmias, coma)
- 6 Management
  - a0 Personal protective equipment
    - (1) Remove patient from the source of poison
  - b0 Airway and ventilation
  - c0 Circulation
    - (1) Monitoring for hypotension as a result of therapy
  - d0 Pharmacological
    - (1) Antidotes
    - (2) Cyanide antidote kit
  - e0 Non-pharmacological
  - f0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
  - g0 Psychological/ communication strategies
- G0 Narcotics/ opiates
  - 1 Clinical uses
  - 2 Common causative agents - heroin, morphine, codeine, meperidine, propoxyphene, fentanyl
  - 3 Pharmacodynamics
  - 4 Pharmacokinetics
  - 5 Assessment findings
    - a0 Euphoria
    - b0 Hypotension
    - c0 Respiratory depression/ arrest
    - d0 Nausea
    - e0 Pinpoint pupils
    - f0 Seizures
    - g0 Coma
  - 6 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
      - (1) Naloxone - opiate specific antidotal therapy
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/ communication strategies
- H0 Cardiac medications
  - 1 Clinical use

- 2 Common causative agents - antidysrhythmics, beta blockers, calcium channel blockers, glycosides
  - 3 Pharmacodynamics
  - 4 Pharmacokinetics
  - 5 Assessment findings
  - 6 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/ communication strategies
- I0 Caustics
- 1 Source
  - 2 Common causative agents - acids and alkali
  - 3 Pharmacodynamics
  - 4 Pharmacokinetics
  - 5 Assessment findings
  - 6 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/ communication strategies
- J0 Common household poisonings
- 1 Sources
  - 2 Common causative agents - bleach, cleaning agents
  - 3 Pharmacodynamics
  - 4 Pharmacokinetics
  - 5 Assessment findings
  - 6 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode

- 
- (2) Appropriate facility
    - f0 Psychological/ communication strategies
  - K0 Drugs abused for sexual purposes/ sexual gratification
    - 1 Sources
    - 2 Common causative agents
    - 3 Pharmacodynamics
    - 4 Pharmacokinetics
    - 5 Assessment findings
    - 6 Management
      - a0 Airway and ventilation
      - b0 Circulation
      - c0 Pharmacological
      - d0 Non-pharmacological
      - e0 Transport considerations
        - (1) Appropriate mode
        - (2) Appropriate facility
    - f0 Psychological/ communication strategies
  - L0 Carbon monoxide
    - 1 Source
    - 2 Common causative agents
    - 3 Pharmacodynamics
    - 4 Pharmacokinetics
    - 5 Assessment findings
    - 6 Management
      - a0 Airway and ventilation
      - b0 Circulation
      - c0 Pharmacological
      - d0 Non-pharmacological
        - (1) Hyperbaric treatment
      - e0 Transport considerations
        - (1) Appropriate mode
        - (2) Appropriate facility
    - f0 Psychological/ communication strategies
  - M0 Alcohols
    - 1 Clinical use/ sources
    - 2 Common causative agents - ethylene glycol, methanol, isopropyl alcohol, ethanol
    - 3 Pharmacodynamics
    - 4 Pharmacokinetics
    - 5 Assessment findings
    - 6 Management
      - a0 Airway and ventilation

- b0 Circulation
  - c0 Pharmacological
    - (1) Antidote
  - d0 Non-pharmacological
  - e0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
  - f0 Psychological/ communication strategies
- N0 Hydrocarbons
- 1 Source
  - 2 Common causative agents - gasoline
  - 3 Pharmacodynamics
    - a0 Aspiration pneumonia
    - b0 CNS depression
    - c0 Acute gastritis
  - 4 Pharmacokinetics
  - 5 Assessment findings
  - 6 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/ communication strategies
- O0 Psychiatric medications
- 1 Tricyclic antidepressants
    - a0 Clinical use
    - b0 Common causative agents - amitriptyline amoxapine, clomipramine, doxepin, imipramine, nortptyline
    - c0 Pharmacodynamics
    - d0 Pharmacokinetics
    - e0 Assessment findings
      - (1) Early findings (dry mouth, confusion, hallucinations)
      - (2) Late findings (delirium, respiratory depression, hypotension, hyperthermia, seizures, coma)
      - (3) Cardiotoxicity - dysrhythmias
    - f0 Management
      - (1) Airway and ventilation
      - (2) Circulation



- (3) Pharmacological
    - (a) Antidote
    - (b) Sodium bicarbonate may reverse the cardiotoxic effects
  - (4) Non-pharmacological
  - (5) Transport considerations
    - (a) Appropriate mode
    - (b) Appropriate facility
  - (6) Psychological/ communication strategies
- 2 Newer anti-depressants and serotonin syndromes
- a0 Clinical uses
  - b0 Common causative agents
  - c0 Common street names
  - d0 Pharmacodynamics
  - e0 Pharmacokinetics
  - f0 Assessment findings
  - g0 Management
    - (1) Airway and ventilation
    - (2) Circulation
    - (3) Pharmacological
    - (4) Non-pharmacological
    - (5) Transport considerations
      - (a) Appropriate mode
      - (b) Appropriate facility
    - (6) Psychological/ communication strategies
- 3 Lithium
- a0 Clinical uses
  - b0 Common causative agents
  - c0 Common street names
  - d0 Pharmacodynamics
  - e0 Pharmacokinetics
  - f0 Assessment findings
  - g0 Management
    - (1) Airway and ventilation
    - (2) Circulation
    - (3) Pharmacological
    - (4) Non-pharmacological
    - (5) Transport considerations
      - (a) Appropriate mode
      - (b) Appropriate facility
    - (6) Psychological/ communication strategies
- 4 MAO inhibitors

- a0 Clinical use
  - b0 Common causative agents
  - c0 Pharmacodynamics
  - d0 Pharmacokinetics
  - e0 Assessment findings
  - f0 Management
    - (1) Airway and ventilation
    - (2) Circulation
    - (3) Pharmacological
    - (4) Non-pharmacological
    - (5) Transport considerations
      - (a) Appropriate mode
      - (b) Appropriate facility
    - (6) Psychological/ communication strategies
- 5 Other
- P0 Non-prescription pain medications
- 1 Nonsteroidal anti-inflammatory agents
    - a0 Clinical uses
    - b0 Common causative agents
    - c0 Common street names
    - d0 Pharmacodynamics
    - e0 Pharmacokinetics
    - f0 Assessment findings
    - f0 Management
      - (1) Airway and ventilation
      - (2) Circulation
      - (3) Pharmacological
      - (4) Non-pharmacological
      - (5) Transport considerations
        - (a) Appropriate mode
        - (b) Appropriate facility
      - (6) Psychological/ communication strategies
  - 2 Salicylates
    - a0 Clinical uses
    - b0 Common causative agents
    - c0 Common street names
    - d0 Pharmacodynamics
    - e0 Pharmacokinetics
    - f0 Assessment findings
    - g0 Management
      - (1) Airway and ventilation
      - (2) Circulation

- (3) Pharmacological
  - (4) Non-pharmacological
  - (5) Transport considerations
    - (a) Appropriate mode
    - (b) Appropriate facility
  - (6) Psychological/ communication strategies
- 3 Acetaminophine
- a0 Clinical use
  - b0 Common causative agents
  - c0 Pharmacodynamics
  - d0 Pharmacokinetics
  - e0 Assessment findings
  - f0 Management
    - (1) Airway and ventilation
    - (2) Circulation
    - (3) Pharmacological
    - (4) Non-pharmacological
    - (5) Transport considerations
      - (a) Appropriate mode
      - (b) Appropriate facility
    - (6) Psychological/ communication strategies
- Q0 Theophylline
- 1 Clinical use
  - 2 Common causative agents
  - 3 Pharmacodynamics
  - 4 Pharmacokinetics
  - 5 Assessment findings
  - 6 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/ communication strategies
- R0 Metals
- 1 Clinical use
  - 2 Common causative agents - iron, lead, mercury
  - 3 Pharmacodynamics
  - 4 Pharmacokinetics
  - 5 Assessment findings

- 6 Management
  - a0 Airway and ventilation
  - b0 Circulation
  - c0 Pharmacological
    - (1) Antidote
  - d0 Non-pharmacological
  - e0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
  - f0 Psychological/ communication strategies
- S0 Plants and mushrooms
  - 1 Clinical use
  - 2 Common causative agents
  - 3 Common street names
  - 4 Pharmacodynamics
  - 5 Pharmacokinetics
  - 6 Assessment findings
  - 7 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological
    - d0 Non-pharmacological
    - e0 Transport considerations
      - (1) Appropriate mode
      - (2) Appropriate facility
    - f0 Psychological/ communication strategies
- T0 Food poisoning
  - 1 Common causative agents
  - 2 Pharmacodynamics
    - a0 Type I reaction
    - b0 Gastrointestinal allergy
    - c0 Bacterial toxins
      - (1) Exotoxins
      - (2) Enterotoxins
    - d0 Neurotoxins
      - (1) Paralytic shellfish poisoning
  - 3 Pharmacokinetics
  - 4 Assessment findings
  - 5 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c0 Pharmacological

- d0 Non-pharmacological
  - e0 Transport considerations
    - (1) Appropriate mode
    - (2) Appropriate facility
  - f0 Psychological/ communication strategies
- U0 Bites and stings
- 1 Common offending organisms - hymenoptera, spider bites, other arthropods, snake bites, marine animal
  - 2 Pharmacodynamics
  - 3 Pharmacokinetics
  - 4 Assessment findings
  - 5 Management
    - a0 Airway and ventilation
    - b0 Circulation
    - c. Pharmacological
    - d. Non-pharmacological
    - e. Transport considerations
      - (1 Appropriate mode
      - (2 Appropriate facility
    - f. Psychological/ communication strategies