Pathophysiology Basics

Course
Pathophysiology

Unit III
Fundamentals of Pathophysiology

Essential Question
How does pathophysiology help healthcare providers find answers to important questions about disease processes?

Rationale
Pathology is a result of disease and changes in homeostasis.

Objectives
Upon completion of this lesson, the student will be able to:
• Evaluate the mechanisms of pathology
• Differentiate between signs and symptoms
• Distinguish between structural and functional disease
• Analyze the effects on the body when it is not in a homeostatic state

Engage
You are at the hospital during your clinical rotations. The medical unit is having an in-service on care of the diabetic patient and they invite you to attend. The presenter talks about some of the signs and symptoms of diabetes such as excessive urination and thirst even though the patient may be losing weight. What is the difference between signs and symptoms? What is pathophysiology or pathogenesis? How does this help the doctor diagnose the disease and treatment plan?

Key Points
I. Homeostasis
   A. The human body strives to maintain internal stability.
   B. The process of maintaining normal balance within the body is called homeostasis.

II. Disease
   A. When homeostasis is not maintained, disease ensues.
   B. Medical professionals who study diseases are called pathologists.
      1. Pathologists are practitioners who specialize in the field.
         a. Two common specialties are
            i. Anatomic pathology – pathologists who perform autopsies to determine cause of death
            ii. Clinical pathology – pathologists who review lab specimens to determine evidence of abnormal tissue or the presence of chemicals

III. Pathophysiology – the study of abnormal functions in the body and how disease processes work

IV. Pathogenesis
   A. Pathogenesis is the development of a disease (-genesis = origin or development).
B. The sequence of events that leads from the cause of disease to structural and functional abnormalities, to how the disease manifests itself, and finally to the resolution or recovery of the disease.

C. Example – the common cold
1. Cause – exposure and inoculation of the cold virus
2. Incubation time – virus multiplies
3. Manifestation – the host begins to have signs and symptoms (sore throat, itchy eyes, runny nose, etc.)
4. Recovery – a return to the previous state of health

D. Pathogenesis of diseases may be explained in terms of time:
1. Acute disease – a disease of sudden onset which runs a severe but short course
2. Chronic – long-term (sometimes reoccurring) illness

V. Predisposing Factors (risk factors)
A. Factors that increase the probability of a person’s becoming ill
1. Age
   a. Newborn babies
      i. Immature immune system
      ii. The liver enzymes necessary for detoxification of some substances are often lacking
      iii. Fewer nutritional reserves
      iv. Less body fat to insulate against cold
   b. The elderly
      i. Decrease in immune function
      ii. Decline in homeostatic mechanisms
      iii. Depression, isolation, and malnutrition
2. Sex – some diseases are more prone to strike one gender than the other
   a. Men are more likely to develop gout
   b. Women are more likely to develop osteoporosis
3. Genetic makeup (familial tendencies for diabetes, asthma, migraines, etc.)
4. Stress – increases body’s production of corticosteroids which decrease immune system function
5. Lifestyle – personal habits in regard to diet, exercise, weight control, smoking, alcohol consumption, sexual practice, etc.
6. Occupation – exposure to loud noises, pollutants, repetitive movements, heavy equipment, high places, etc.
7. Preexisting illnesses
   a. Illnesses can lower the body’s resistance and make individuals more susceptible to other diseases
   b. Chronic illness interferes with the proper function of some body systems; therefore complicating disease
8. Environmental exposure
a. Prolonged exposure to cold or heat can lower the body’s resistance
b. Exposure to allergens
c. Long-term exposure to sunlight
d. Long-term exposure to occupational chemicals

VI. Two Main Disease Categories
A. Disease processes can be categorized into one of two groups: structural and functional.
   1. **Structural Disease** (sometime called *Organic Disease*)
      a. Involves physical and biochemical changes within the cells
      b. Structural changes in cells are initiated by two types of agents:
         i. *Exogenous* – those that are external, i.e. trauma, chemical injury, and microbial infections
         ii. *Endogenous* – those that are internal, i.e. vascular insufficiency, immunological/autoimmune reactions, and diseases that are a result of abnormal metabolism
      c. The hallmark characteristic of structural disease is the lesion.
         i. The word *lesion* comes from Latin, and means “to hurt.”
         ii. *Lesion* is a widely used term to describe many types of cellular changes that result in tissue abnormalities (cuts, fractures, masses, etc.).
         iii. Lesions are primarily detected by observation with the naked eye or with a microscope.
   B. **Functional Disease** (sometimes called *Physiological Disease*)
      1. Diseases in which the onset begins without the presence of any lesion
      2. The basic change is physiological and is referred to as a pathophysiological change.
      3. Examples of functional diseases are tension headaches and functional bowel syndrome.
      4. Although mental illnesses have been considered functional disorders, present research now indicates that many have a genetic or organic basis (on a biochemical level).
C. Examples Of Varying Effects Of Structural And Functional Diseases

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<thead>
<tr>
<th>Disease</th>
<th>Type of Disease</th>
<th>Nature of Manifestation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common cold</td>
<td>Structural (viral infection)</td>
<td>Structural (runny nose sneezing)</td>
</tr>
<tr>
<td>Tension headaches</td>
<td>Functional (muscle spasm)</td>
<td>Functional (pain)</td>
</tr>
<tr>
<td>A benign tumor that produces mass</td>
<td>Structural (tumor)</td>
<td>Structural (mass)</td>
</tr>
<tr>
<td>Exogenous obesity caused by craving food</td>
<td>Functional (hunger)</td>
<td>Structural (obesity)</td>
</tr>
<tr>
<td>Cancer of the esophagus</td>
<td>Structural (cancer)</td>
<td>Functional (inability to eat)</td>
</tr>
</tbody>
</table>

VII. A Closer Look at Causes of Disease

A. To better understand and identify different structural diseases and their causes, they are commonly sub-classified:

1. Infectious Diseases
   a. Diseases that are caused by invasion and colonization of pathogenic microorganisms
   b. Examples of pathogenic infection
      i. fungal infection
      ii. bacterial infection
      iii. viral infection

2. Neoplasms (“new growth”)
   a. The uncontrolled growth of abnormal cells
   b. Growth may be benign or malignant (cancerous)

3. Immunologic Diseases – three immunologic categories
   a. Overreaction by the immune system (hypersensitivity)
   b. Underreaction by the immune system (immune deficiency disease such as AIDS)
   c. Autoimmune disease – destruction of one’s own tissues by antibodies produced by one’s own immune system

4. Nutritional Diseases
   a. Diseases created by insufficient resources for the body
      i. Protein deficiency – difficulty in healing or formation of new body tissue; decrease in antibody production
      ii. Vitamin or mineral deficiencies – may lead to interference in biochemical reactions of metabolism
   b. Obesity

5. Metabolic Diseases
   a. An upset in the biochemical reactions that govern body processes or metabolism
b. Sub-classified as nutritional because the upset is often connected to carbohydrate, fat, or protein metabolism

6. Genetic Diseases
   a. Inherited or hereditary diseases due to transmission of defective gene(s) or chromosome(s) from one or both parents
   b. Examples of genetic diseases are diabetes, Down Syndrome, hemophilia, cleft lip

7. Congenital Disease (also referred to as an anomaly or defect)
   a. A defect in fetal development that may create a functional (physiologic) or structural (physical) abnormality which presents itself at birth
   b. These defects may be genetic; they may be exposure to chemicals, drugs, or viruses during the pregnancy; or they may be a spontaneous event

8. Trauma
   a. A physical force that mechanically disrupts the structure of the body (and therefore, disrupts body function)
   b. Results of trauma are generally referred to as injuries
   c. Results of trauma include bruises, abrasions, cuts, fractures, burns, etc.

9. Physical Agents – diseases that result from physical agents such as temperature extremes, electrical shock, radiation, or poisons

10. Inflammatory Diseases – diseases that are usually secondary to primary disease, such as infection or autoimmune disease

VIII. The Disease Process
   A. Manifestations of Disease
      1. To treat a patient, a physician must first know the manifestations of a disease.
      2. Manifestation means how a disease “presents or shows itself.”
      3. Manifestation is also called clinical presentation and includes both signs and symptoms.
         a. Signs
            i. Objective physical observations as noted by the person who examines the patient
            ii. This examination is called a physical or physical examination
            iii. During the physical, the health professional may use techniques such as
                a) Inspection (looking at or observing areas of the body)
                b) Auscultation (use of a stethoscope to listen to body cavities)
c) **Palpation** (feeling lightly or pressing firmly on internal organs or structures)

d) **Percussion** (tapping various body areas to produce a vibrating sound indicative of air, fluid, size of organ, etc.)

e) **Olfaction** (using smell to note abnormalities)

iv. Examples of signs are temperature, blood pressure, respiratory rate, abnormal heart sounds, mass, enlarged organs, edema

b. **Symptoms** refer to the patient’s awareness of abnormalities or discomfort. Symptoms are not measurable and are based on the patient’s subjective perception, i.e. pain, nausea, weakness, fatigue, and dizziness

i. The written description of symptoms in the patient’s record is referred to as the **patient history**.

B. Care of the Patient

1. Caring for the patient involves three major steps:

a. Obtaining a history to ascertain the patient’s symptoms and to review any past or present medical problems that might relate

b. Performing a physical examination of the patient

c. Laboratory tests, and radiologic and clinical procedures to detect chemical and physiologic abnormalities to aid in establishing the diagnosis

C. Etiology and Related Terms

1. The **etiologies** of a disease is its cause (the term literally means *the study of causes*)

a. If the cause of a disease has never been discovered (disease is unknown), the cause is referred to as **idiopathic**.

b. One may also refer to an idiopathic disease as having “unknown etiology.”

2. **Iatrogenic** disease (-iatro = medicine, physician) means that the disease arose as a result of a prescribed treatment

a. Examples

   i. Cushing-like Syndrome as a result of steroid therapy

   ii. Immunosuppression and/or anemia as a result of chemotherapy

3. A **healthcare acquired** disease is one that was acquired from a clinical setting (e.g. hospital, physician’s office, clinic).

a. A postoperative patient develops staph infection from a surgical instrument that wasn’t properly sterilized

b. A child develops a cold after being exposed to other sick children at the pediatrician’s office
D. Diagnosis
   1. The process of assigning a name to a patient’s condition
   2. When clusters of findings with more than one disease are found, they are called syndromes.
   3. A diagnosis is needed to determine the treatment and potential outcome of a disease.

E. Treatment (therapy)
   1. The treatment of a disease should be as precise as possible in order to attempt a cure.
   2. Treatment interventions may include exercise, nutritional modifications, physical therapy, medications, surgery, and education.
   3. Three common therapies are
      a. Supportive therapy – a conservative therapy that includes rest, optimal nutrition, fluids, and possibly antibiotics to prevent a secondary infection while the immune system is recovering
      b. Palliative therapy – not a curative therapy; provides relief from signs and symptoms of a disease
         i. Examples of this therapy might include steroids, pain relievers, possible surgery (removal of a tumor, etc.)
         ii. This treatment is used for terminal illnesses and other serious chronic conditions for which there is no cure.
      c. Preventive therapy – care that is given to prevent disease. Examples of preventive therapy might include mammograms, blood pressure screenings, routine dental care, colon cancer tests

F. Prognosis
   1. The prognosis is the predicted or expected outcome of the disease.
   2. Prognosis is often listed as
      a. Good (full recovery)
      b. Guarded (full recovery may or may not occur)
      c. Poor (not expected to recover)

IX. Additional Terminology
   A. Communicable disease – a disease that can be transmitted from one person to another
   B. Epidemic – a disease that affects many people in a given region at the same time
   C. Endemic – a disease that appears to be indigenous to a particular area or region (not of epidemic proportions)
   D. Localized disease – a disease that is confined to one area of the body
E. **Systemic (generalized) disease** – a disease that spreads throughout the body, or to many systems

F. **Asymptomatic (sub-clinical) disease** – a disease in which the symptoms are not noticeable to the patient; the presence of disease (signs) is detected by a routine physical or testing

G. **Self-limiting disease** – a disease that does not require treatment to be cured; it will resolve on its own

**Activity**

I. Research and report on a specific disease or disorder. Include in the report the definition of the disease, the signs and symptoms, whether it is a structural or functional disease, and the diagnosis and treatment. See the Disease Report Template.

II. Design a poster to represent examples of disease categories.

**Assessment**

Successful completion of the quiz: **Pathophysiology Basics**

**Materials**

Pathophysiology Basics Quiz Key
Disease Report Rubric

**Accommodations for Learning Differences**

For reinforcement, the student will list and define key terms.

For enrichment, the student will read and report on a forensic pathology report.

**National and State Education Standards**

**National Health Science Cluster Standards**

**HLC01.01** Academic Foundations: Health care workers will know the academic subject matter required for proficiency within their area. They will use this knowledge as needed in their role. Compare selected diseases/disorders including respective classifications causes, diagnoses, therapies and care/rehabilitation to include biotechnological applications.

**HLC02.01** Communications: Use medical terminology within a scope of practice in order to interpret, transcribe and communicate information, data and observations

**TEKS**

130.208 (c)(2)(A) know the definition of science and understand that it has limitation, as specified in subsection (b) (2) of this section.
130.208 (c)(2)(B) know that hypotheses are tentative and testable statements that must be capable of being supported by observational...
evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories. 130.208 (c)(3)(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles and marketing material. 130.208 (c)(3)(D) evaluate the impact of scientific research on society and the environment

Texas College and Career Readiness Standards
English-Reading
B.1 Identify new words and concepts acquired through study of their relationships to other words and concepts
2 Apply knowledge of roots and affixes to infer the meaning of new words 3.Use reference guides to confirm the meanings of new words or concepts

Science-Nature of Science: Scientific Ways of Learning and thinking
E.2. Use essential vocabulary of the discipline being studied

Science-Foundation Skills
B 3 Recognize scientific and technical vocabulary in the field of study and use this vocabulary to enhance clarity of communication
Quiz: Pathophysiology Basics

1. An abnormal functional change in the body is
   a. disease  
   b. diagnosis  
   c. etiology  
   d. idiopathic

2. The sequence of events that leads from the cause to the signs and symptoms is
   a. disease  
   b. etiology  
   c. pathogenesis  
   d. syndrome

3. The study of causes is
   a. diagnosis  
   b. etiology  
   c. pathology  
   d. pathogenesis

4. The process of assigning a name to a patient’s condition is
   a. disease  
   b. diagnosis  
   c. etiology  
   d. syndrome

5. Symptoms, signs, and laboratory findings are what aspects of disease?
   a. biochemical  
   b. congenital  
   c. manifestations  
   d. developmental

6. Evidence of disease as perceived by the patient is
   a. lesions  
   b. injuries  
   c. signs  
   d. symptoms

7. A written description of symptoms is a
   a. complaint  
   b. sign  
   c. manifestation  
   d. history

8. Physical observations by the healthcare professional are referred to as
   a. signs  
   b. symptoms  
   c. manifestations  
   d. history

9. A cellular change that results in a tissue abnormality is broadly referred to as
   a. necrosis  
   b. inflammation  
   c. a lesion  
   d. an injury

10. Neoplasms and injuries are all forms of
    a. functional disease  
    b. structural disease

11. A congenital disease is one that is
    a. genetically acquired  
    b. acquired by sexual contact  
    c. present at birth  
    d. functional
12. A disease that is passed from one person to another is called
   a. a generalized disease  
   b. a communicable disease  
   c. an epidemic  
   d. a nosocomial disease

13. Disease that develops quickly and does not last a long period of time is
   a. acute disease  
   b. iatrogenic disease  
   c. chronic disease  
   d. idiopathic disease

14. Etiology means
   a. of unknown cause  
   b. the probable outcome of a disease  
   c. cause of a disease  
   d. a physical or structural injury

15. Treatment in which a terminally ill patient is provided relief from the signs and symptoms is
   a. preventive treatment  
   b. supportive treatment  
   c. hospice  
   d. palliative treatment

16. When symptoms are not noticeable in the presence of disease, this is called
   a. asymptomatic disease  
   b. chronic disease  
   c. localized disease  
   d. iatrogenic disease

17. Use of a stethoscope to listen to body cavities is called
   a. percussion  
   b. auscultation  
   c. palpation  
   d. palliative

18. A disease arising as a result of a prescribed treatment is a/an
   a. iatrogenic disease  
   b. nosocomial disease  
   c. idiopathic disease  
   d. functional disease

19. Homeostasis is
   a. a genetic predisposition for metabolic disease  
   b. a state of maintaining normal balance in the body  
   c. how a disease manifests itself  
   d. a nutritional upset in the body

20. Neoplasms are
   a. infectious diseases  
   b. uncontrolled growths of abnormal cells  
   c. upsets in biochemical reactions  
   d. bone calluses surrounding a fracture
Answers Quiz: Pathophysiology Basics

1. a.
2. c.
3. b.
4. b.
5. c.
6. d.
7. d.
8. a.
9. c.
10. b.
11. c.
12. b.
13. a.
14. c.
15. d.
16. a.
17. b.
18. a.
19. b.
20. b.
<table>
<thead>
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<th>Disease Report Template</th>
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<tbody>
<tr>
<td><strong>Disease</strong></td>
</tr>
<tr>
<td><strong>Alternate Names</strong></td>
</tr>
<tr>
<td><strong>Definition</strong></td>
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<tr>
<td><strong>Etiology</strong></td>
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<tr>
<td><strong>Signs &amp; Symptoms</strong></td>
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<td><strong>Diagnostic Tests</strong></td>
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<td><strong>Treatment</strong></td>
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<tr>
<td><strong>Complications</strong></td>
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<tr>
<td><strong>Prognosis</strong></td>
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<td><strong>Bibliography</strong></td>
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# Disease Report Rubric

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Possible Points</th>
<th>Points Awarded</th>
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<tbody>
<tr>
<td><strong>Disease</strong></td>
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<tr>
<td>Correctly names the disease</td>
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<tr>
<td><strong>Alternate Names</strong></td>
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<tr>
<td>If applicable, includes any alternate names for the disease or disorder</td>
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<tr>
<td><strong>Definition</strong></td>
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<tr>
<td>Includes in-depth discussion of the history and general description of the disease with interesting facts</td>
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<td><strong>Etiology</strong></td>
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<tr>
<td>Includes the cause or origin of the disease or disorder</td>
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<tr>
<td><strong>Signs &amp; Symptoms</strong></td>
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<tr>
<td>Accurately describes the common physical and medical symptoms</td>
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<td><strong>Diagnostic Tests</strong></td>
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<tr>
<td>Identifies tests performed to aid in the diagnosis or detection of the disease or disorder</td>
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<tr>
<td><strong>Treatment</strong></td>
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<tr>
<td>Identifies the mode or course pursued for remedial ends for the disease or disorder</td>
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<tr>
<td><strong>Complications</strong></td>
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<tr>
<td>Identifies any diseases or injuries that may develop during the treatment of the disease or disorder</td>
<td>10</td>
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<td><strong>Prognosis</strong></td>
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<tr>
<td>Includes the prediction of the probable course, outcome, frequency, and life expectancy of the disease or disorder</td>
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<td>Follows the proper format and includes more than 3 sources</td>
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