Pathophysiology Basics

OBJECTIVES/RATIONALE
Pathology is a result of disease and changes in homeostasis. The student will understand the mechanisms of pathology.
I. Fundamentals of Disease

○ A. Homeostasis
  ● 1. The human body strives to maintain internal stability.
  ● 2. The process of maintaining normal balance within the body is called *homeostasis*.
B. Disease

1. When homeostasis is not maintained, disease ensues.
2. Medical professionals who study diseases are called pathologists.
II. Pathologists are practitioners who frequently specialize in the field.

A. Two common specialties are:

- 1. anatomic pathology – pathologists who perform autopsies to determine cause of death
- 2. clinical pathology – pathologists who review lab specimens to determine evidence of abnormal tissue, presence of chemicals
II. Pathologists are practitioners who frequently specialize in the field.

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

- A. The development of a disease is referred to as pathogenesis (-genesis = origin or development).

- B. The sequence of events that leads from cause of disease to structural and functional abnormalities, to how the disease manifests itself and finally to the resolution or recovery of the disease.
III. Pathogenesis

C. Example: common cold

1. **Cause** = exposure and inoculation of cold virus
   - 2. **Incubation time** = virus multiplies
   - 3. **Manifestation** = host begins to have signs and symptoms (sore throat, itchy eyes, runny nose, etc.)
   - 4. **Recovery** = return to previous state of health
III. Pathogenesis

D. pathogenesis of a disease may be explained in terms of time:

1. **acute disease** – disease of sudden onset which runs a severe but short course

2. **chronic** – long-term (sometimes reoccurring) illness
IV. Predisposing Factors (risk factors)

* Factors that increase probability of a person’s becoming ill

- 1. **Age**
  - Newborn babies
  - 1) immature immune system
  - 2) liver enzymes necessary for detoxification of some substances are often lacking
  - 3) fewer nutritional reserves
  - 4) less body fat to insulate against cold
IV. Predisposing Factors (risk factors)

- **Elderly**
  - 1) decrease in immune function
  - 2) decline in homeostatic mechanisms
  - 3) depression; isolation; malnutrition

- **Sex** - some diseases are more prone to one gender than the other
  - 1. men more likely to develop gout
  - 2. women more likely to develop osteoporosis
IV. Predisposing Factors (risk factors)

○ 3. **Genetic makeup** (familial tendencies for: diabetes, asthma, migraines, etc.)

○ 4. **Stress** - increases body’s production of corticosteroids, which decreases immune system function.
IV. Predisposing Factors (risk factors)

- 5. **Lifestyle** - personal habits in regard to diet, exercise, weight control, smoking, alcohol consumption, sexual practice
- 6. **Occupation** - exposure to loud noises, pollutants, repetitive movements, heavy equipment, high places, etc.
IV. Predisposing Factors (risk factors)

7. **Preexisting illness**
   1. illnesses can lower body’s resistance and make individuals more susceptible to other diseases
   2. chronic illness interferes with proper function of some body systems, therefore complicating disease
IV. Predisposing Factors (risk factors)

8. **Environmental exposure**
   - 1. prolonged exposure to cold or heat can lower the body’s resistance
   - 2. exposure to allergens
   - 3. long-term exposure to sunlight
   - 4. long-term exposure to occupational chemicals
V. Two Main Disease Categories

* Disease processes can be categorized into one of two groups: structural or 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.
Structural Disease
Endogenous vs. Exogenous

Possible causes of Cushing’s syndrome

Endogenous Cause:
Overproduction of cortisol (a glucocorticoid) caused by either:

- Pituitary tumor
  (Cushing’s disease), 70% of endogenous cases
- Adrenal tumor,
  15% of endogenous cases
- Other or unknown causes,
  15% of endogenous cases

Exogenous Cause:
Taking medicines containing glucocorticoids, such as hydrocortisone
V. Two Main Disease Categories

- B. The hallmark characteristic of structural disease is the *lesion.*
  - *Lesion*: underlying defect in a cell or tissue and ultimately provides a target for treatment or a cure

- The word lesion comes from Latin language and means “to hurt.”

- *Lesion* is a widely used term to describe many types of cellular changes that result in tissue abnormalities. (cuts, fractures, masses, etc.)

- Lesions are primarily detected by observation with the naked eye or with a microscope.
V. Two Main Disease Categories

II. Functional Disease (sometimes called physiological disease); an abnormal change in function of an organ but no structural alteration

1. Diseases in which the onset begins without the presence of any lesion.
2. The basic change is physiologic and is referred to as a pathophysiologic change.
3. Examples of functional disease 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).
### VI. Examples Of Varying Effects Of Structural And Functional Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Type of Disease</th>
<th>Nature of Manifestations</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>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 esophagus</td>
<td>Structural (cancer)</td>
<td>Functional (inability to eat)</td>
</tr>
</tbody>
</table>
VII. Closer Look at Causes of Disease

- A. To better understand and identify different structural diseases and their cause, they are commonly sub-classified:
  - 1. **Infectious Diseases**
    - a. those diseases that are caused by invasion and colonization of pathogenic microorganisms
    - b. examples of pathogenic infection: fungal infection, bacterial infection, and viral infection
VII. Closer Look at Causes of Disease

2. **Neoplasms** (“new growth”)
   - a. the uncontrolled growth of abnormal cells
   - b. growth may be benign or malignant (cancerous)
VII. Closer Look at Causes of Disease

3. Immunologic Diseases

*Three immunologic categories:*

- 1. overreaction by immune system (hypersensitivity)
- 2. underreaction by immune system (immune deficiency disease such as AIDS).
- 3. autoimmune disease – destruction of one’s own tissues by antibodies produced by one’s own immune system
VII. Closer Look at Causes of Disease

- 4. **Nutritional Diseases** - diseases created by insufficient resources for the body
  - 1. protein deficiency – difficulty in healing or formation of new body tissue; decrease in antibody production
  - 2. vitamin or mineral deficiencies – may lead to interference in biochemical reactions of metabolism
  - 3. Obesity
VII. Closer Look at Causes of Disease

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
VII. Closer Look at Causes of Disease

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 might be: diabetes, Down Syndrome, hemophilia, cleft lip
VII. Closer Look at Causes of Disease

7. Congenital Disease (also referred to 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; they may be a spontaneous event
VII. Closer Look at Causes of Disease

8. Trauma

a. physical force that mechanically disrupts the structure of the body (therefore, disrupts body function)

b. result of trauma is generally referred to as an injury

c. results of trauma include bruises, abrasions, cuts, fractures, burns, etc.
VII. Closer Look at Causes of Disease

9. Physical Agents - diseases that result from physical agents such as temperature extremes, electrical shock, radiation, and poisons
VII. Closer Look at Causes of Disease

- 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

a. To treat a patient, a physician must first know the manifestations of a disease.

b. **Manifestation** refers to how a disease “presents or shows itself”. 
VIII. The Disease Process

- c. Manifestation is also called *clinical presentation* and includes both *signs* and *symptoms*.

- 1. *Signs (measurable)*
  - i. objective physical observations as noted by the person who examines the patient
  - ii. this examination is called a *physical* or the *physical examination*
VIII. The Disease Process

- iii. during the physical, the health professional may use techniques such as:
  - **ausculation** (use of stethoscope to listen to body cavities)
  - **palpation** (feeling lightly or pressing firmly on internal organs or structures)
  - **percussion** (tapping over various body areas to produce vibrating sound that is indicative of air, fluid, size of organ)

- iv. examples of signs are: temperature, blood pressure, respiratory rate, abnormal heart sounds, mass, enlarged organs, edema
VIII. The Disease Process

2. **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, dizziness

- d. The written description of symptoms in the patient’s record is referred to as the *patient history.*
VIII. The Disease Process

B. Care of the Patient

a. Caring for the patient involves three major steps:

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

2. performing a physical examination on the patient
VIII. The Disease Process

3. laboratory tests, radiologic, and clinical procedures to detect chemical and physiologic abnormalities to aid in establishing the diagnosis
VIII. The Disease Process

C. Etiology and Related Terms
   a. The *etiology* of disease is its cause (term literally means the study of causes).
   1. If the cause of a disease has never been discovered (disease is unknown), the cause is referred to as *idiopathic*.
   2. One may also refer to an idiopathic disease as “unknown etiology”.
VIII. The Disease Process

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

○ *examples:*
  - i. Cushing-like Syndrome as a result of steroid therapy
  - ii. immunosupression and/or anemia as a result of chemotherapy
Cushings Syndrome
C. A *nosocomial* disease is one that was acquired from a clinical setting (e.g. hospital; physician’s office; clinic).

- 1. postoperative patient develops staph infection from surgical instrument that wasn’t properly sterilized
- 2. child develops cold after being exposed to other sick children at the pediatrician’s office

CDC- standards for infection control

*WHAT* is the BEST way to prevent an illness or sickness that we can do very easily?
VIII. The Disease Process

D. Diagnosis

- a. Process of assigning a name to a patient’s condition.
- b. When clusters of findings with more than one disease are found, they are called **syndromes**.
- c. Diagnosis is needed to determine the treatment and potential outcome of a disease.
E. Treatment (therapy)

- a. Treatment of a disease should be as precise as possible in order to attempt a cure.
- b. Treatment interventions may include: exercise, nutritional modifications, physical therapy, medications, surgery, and education.
VIII. The Disease Process

c. Three common therapies are:

1. **Supportive therapy** – conservative therapy that includes rest, optimal nutrition, fluids, possible antibiotics to prevent a secondary infection while the immune system is recovering
VIII. The Disease Process

2. **Palliative therapy** – not a curative therapy; provides relief from signs and symptoms of their disease
   - a. Examples of this therapy might include: steroids, pain relievers, possible surgery (removal of tumor, etc.)
   - b. This treatment used for terminal illnesses and other serious chronic conditions for which there is no cure
VIII. The Disease Process

3. **Preventive therapy** – care that is given to prevent disease, i.e. *THE BEST OPTION*

Examples of preventive therapy might include: mammograms, blood pressure screenings, routine dental care, colon cancer tests

**Holistic Care**
F. Prognosis

a. The prognosis is the predicted or expected outcome of the disease

b. Prognosis is often listed as:
   - 1. Good (full recovery)
   - 2. Guarded (full recovery may or may not occur)
   - 3. Poor (not expected to recover)
IX. Additional Terminology

- **Communicable disease** – a disease that can be transmitted from one person to another
- **Epidemic** – a disease that affects many people in a given region at the same time
IX. Additional Terminology

- **Endemic** – a disease that appears to be indigenous to a particular area or region (not of epidemic proportions)

- **Localized disease** – disease is confined to one area of body.

- **Systemic (generalized) disease** – disease that spreads throughout the body or to many systems
IX. Additional Terminology

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

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

- **Mortality** - # of people who die from a disease per 100,000 who have the disease
- **Survival Rate** - % of people with a disease who live for a set period of time
- **Exacerbation relapse** - return of symptoms after their apparent cessation (chronic diseases)
- **Remission** - signs and symptoms of a chronic disease subside