Introduction to pathology

By

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Clinical Medicine & Pathology 316

1st Lecture
Lecture outline

• Pathology.
• Disease.
• Cell injury.
• Manifestations of disease.
• Structural diseases.
• Functional diseases.
• Causes of disease.
• Patient care.
Pathology

• **What is the definition of pathology?**
  - In the broadest sense, pathology is the study of disease. **Be more specific please?**
  - A more specific meaning of pathology is the medical disciplines that deals with analysis of body fluids and tissues for diagnostic purposes. **Is that all?**
  - Pathology can also be directed to teaching and research relating to fundamental aspects of disease.

• **Who is a pathologist?**
  - Experimental, anatomic & clinical pathologists. **Is that all?**
  - Academic pathologists.
Pathology

1. **Experimental pathologist.**
   - Scientists who spend the majority of their time investigating the causes & mechanisms of disease.

2. **Anatomic pathologist.**
   - Pathologists who perform autopsies, examine all tissues removed from live patients (surgically) and examine cell preparations used to screen for cancer cells (cytology).

3. **Clinical pathologist.**
   - Pathologists who analyze various specimens removed from patients, such as blood, urine, spinal fluid, blood cells and microorganisms.
4. Academic pathologist.

- Pathologists in health science teaching centers who combine teaching & experimental pathology with an interest in one or more of the special areas of anatomic or clinical pathology.

Like who?

- PT.
- RS.
- NM.
- MLS.
- HIA.
- OT.
Disease

- **What is the definition of disease?**
  - Disease is a structural or functional change within the body judged to be abnormal. *A small note>>> how about minor changes?*
  - Minor changes that are of no importance may be judged to be variations of the normal state rather than disease.
  - **Is there a difference between pathology & disease?**
  - Yes. *How?*
  - Pathology not only includes the study of basic structural & functional changes associated with a disease, but also the study of causes (etiology) that lead to the structural & functional changes and manifestations that result from them.
  - The sequence of events that leads from cause to structural & functional abnormalities and finally to manifestations is referred to as (pathogenesis).
• **Do all diseases have a specific diagnosis name?**
  - No. how?
  - Diagnosis is the process of assigning a name to a patient’s condition, e.g., multiple sclerosis, Alzheimer... etc.
  - If the findings cannot be expressed in terms of a disease, the clinical problem is used as the diagnosis until the patient’s disease become evident.
  - What if a single patient has more than one disease with common clusters of findings such as leakage of protein into the urine, low serum protein, and edema?
  - The above clusters is common with renal glomerulus and combined to be referred to as nephrotic syndrome.
  - In short, some conditions are diagnosed as diseases others as syndromes.
Cell injury

• How do we diagnose a disease?
  - Altered functions of cells as they respond to injury & the response of the body to the injured cells are the principle determinations of symptoms perceived as disease.
  - Can cell injury be noticed by the patient?
  - It depends on its extent, duration and the location of the injured cells.
  - A good example is a small abrasion of the skin might well go unnoticed by the patient, but injury to a similar number of cells in a critical portion of the central nervous system could lead to paralysis. Why?
  - Location, location, location.
Cell injury

- The main classifications of cells are:
  1. Epithelial cells.
  2. Connective tissue cells.

- Do they react similarly to disease situations? How?
- Off course they do not.
- Epithelial cells work with each other in tight clusters to carry out specialized functions, such as protection of body surfaces, secretion of specific products and special metabolic functions.
- Connective tissue cells, on the other hand, are more loosely arranged & are involved in general support functions, such as providing physical support and promoting appropriate movement of fluids & nutrients.
Cell injury

• What happens after a cell is injured?

1. Necrosis.
2. Inflammation.
3. Repair.

- Necrosis is>>>
  - The death of cells or tissue in a localized area of the body due to injury.

- Inflammation is>>>  
  - The vascular & cellular response to necrosis or sublethal (cell injury without necrosis) cell injury & is the body’s mechanism of limiting the spread of injury & removing necrotic debris.

- Repair is>>>  
  - The body’s attempt to replace dead cells by regeneration or replacement.
Cell injury

• What are the main causes of cell injury?

1. Anoxia (lack or reduced oxygen).
2. Toxins (endogenous & exogenous).
3. Infections.
4. Immunologic processes.
5. Metabolic & genetic abnormalities.
6. Physical agents.
7. Trauma.
Manifestations of disease

- **What does manifestations of disease mean?**
  - It refers to the data that can be gathered about an individual patient, namely, symptoms, signs, and laboratory abnormalities.
  - **What does (symptoms) mean?**
  - They are evidence of disease perceived by the patient, such as pain, lump, or diarrhea.
  - Following symptoms discussion with the patient, some key elements must be noted. **What are they?**
  - History, signs, physical examinations and laboratory abnormalities.
Manifestations of disease

• **History is >>>**
  - The written description of symptoms in the patient’s record.

• **Signs are >>>**
  - The physical observations made by the person who examines the patient, such as tenderness, a mass, or abnormal heart sounds.

• **Physical examination is >>>**
  - The responsible element of disease manifestations that record the signs.

• **Laboratory abnormalities is >>>**
  - In the broad sense, it refers to the observations made by tests or special procedures, such as x-rays, blood counts or biopsies.
Structural diseases

• What happens after gathering disease manifestations?
  - Diseases get to be categorized in order to select the most appropriate treatment or prevention plan. What are the main categories?
  - Structural and functional diseases.
  - Structural is >>>
  - They are those diseases characterized by structural changes within the body as the most basic abnormality. Do they have another name?
  - Yes, organic diseases.
Structural diseases

- **What is the most prominent signs of structural diseases?**

- Lesions....

- Lesions may be biochemical or morphologic (visible).

- The term lesion is most often used in reference to morphologic change whether it be at the gross (naked eye), microscopic, or electron microscopic level.

- **Is there categories within structural diseases & what are they?**

- Yes. *Genetic & developmental diseases, acquired injuries & inflammatory diseases, and hyperplasias & neoplasms.*

- There are other structural diseases that fall into more than one category and some are difficult to classify.
Structural diseases

1. **Genetic & developmental diseases.** What are they?

- In the broad sense, they are caused by abnormalities in the genetic makeup of the individual (either genes or chromosomes) or abnormalities due to changes in utero (during embryonic and fetal development). **Examples >>>**

- Deformities present at birth (congenital anomalies), biochemical changes caused by genes but influenced by environment so they appear later in life, e.g., diabetes mellitus.

- There are many genetic & developmental diseases that can also be classified as injuries, inflammations, proliferations or even neoplasms.
2. **Acquired injuries & inflammatory diseases.** What are they?

- They are diseases due to *internal* or *external* forces or agents that destroy cells or intercellular substances, deposit abnormal substances (foreign bodies or materials produced by the body), or cause the body to injure itself by means of inflammatory process.

- **What are the external agents of injury?**

- They include physical & chemical substances and microbes.

- **How about internal agents?**

- The major internal agents of injury are vascular insufficiency, immunologic reactions, and metabolic disturbances.
Structural diseases

- So what is the main target of acquired injuries & inflammatory diseases?
  - Cells...
  - As mentioned earlier cells may experience more than type of injuries, refresh my memory please??
  - Necrosis or sublethal cell injury (degeneration).
  - Necrosis: cells are killed in the injured area.
  - Sublethal: cells are capable of recovery.
  - As mentioned earlier, inflammation and repair are next steps to manage cell injury.
  - It should be noted that repair is greatly influenced by the type of tissue or organ that has been injured, unlike necrosis and inflammation.
Structural diseases

3. **Hyperplasias & neoplasms.** What are they?

- They are one category of structural diseases that can be characterized by increases in cell populations.
- Cell increase in hyperplasias & neoplasms is beyond normal, unlike repair process with acquired injuries and inflammatory diseases.
- **So what is the main difference between hyperplasia & neoplasia?**
- Hyperplasia is a proliferation reaction to a prolonged external stimulus and will usually regress when the stimulus is removed.
- Neoplasia is presumed to result from a genetic change producing a single population of new (neoplastic) cells, which can proliferate beyond the degree allowed.
Structural diseases

• **What are the two categories of neoplasia?**
  - **Benign and malignant.** How do they differ?
  - Benign neoplasia remain localized.
  - Malignant neoplasia continue to grow and spread.
  - Both benign and malignant neoplasias are referred to as cancer.
Functional diseases

• What are functional diseases?
  - They are characterized as those diseases in which the onset (cause) begins without the presence of any lesions. So how do they begin?
  - The basic change is a physiologic or functional change and is referred to as a pathophysiologic change. Examples?
  - Tension headache, functional bowel syndrome, disorders that are due to unconscious stimulation of the nervous system, and some mental illness.
  - It should be clearly understood that some long-standing functional diseases may, however, lead to secondary structural changes as demonstrated in the table next slide.
### Functional diseases

- **Table 1: Examples of varying effects of structural & functional diseases.**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Type of disease</th>
<th>Nature of manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tension headaches</td>
<td>Functional (muscle spasm)</td>
<td>Functional (pain)</td>
</tr>
<tr>
<td>Benign tumor of the breast that produces mass</td>
<td>Structural (tumor)</td>
<td>Structural (mass)</td>
</tr>
<tr>
<td>Exogenous obesity caused by craving for food</td>
<td>Functional (hunger)</td>
<td>Structural (obesity)</td>
</tr>
<tr>
<td>Cancer of the esophagus that prevents eating</td>
<td>Structural (cancer)</td>
<td>Functional (inability to eat)</td>
</tr>
</tbody>
</table>
Causes of disease

• **How do a disease initiates?**
  - Diseases are initiated by injury, which may be either external or internal in origin. *What is the medical terminology for external or internal origin of a disease?*
  - Agents acting from without are termed **exogenous**, those acting from within are referred to as **endogenous**.
  - External causes of diseases are divided into physical, chemical, and microbiologic as detailed in table 2.
  - In this category of disease causes, the term infectious disease can often be used.
## Causes of disease

- **Table 2: External causes of disease.**

<table>
<thead>
<tr>
<th>Physical injury</th>
<th>Chemical injury</th>
<th>Microbiologic injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma</td>
<td>Poisoning</td>
<td>Bacteria</td>
</tr>
<tr>
<td>Heat-cold</td>
<td>Drug reactions</td>
<td>Fungi</td>
</tr>
<tr>
<td>Electricity</td>
<td></td>
<td>Rickettsia</td>
</tr>
<tr>
<td>Pressure</td>
<td></td>
<td>Viruses</td>
</tr>
<tr>
<td>Ionizing radiations</td>
<td></td>
<td>Protozoa</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Helminths</td>
</tr>
</tbody>
</table>
Causes of disease

- What are the main categories of internal causes of disease?
  - Internal causes of disease fall into three large categories including, vascular diseases, immunologic diseases, and metabolic diseases.
  - Internal causes of disease can result in obstruction of blood supply to an organ or tissue, bleeding, or altered blood flow such as occurs with heart failure. They also result in deficiency in the immune system of the body as well as a wide variety of biochemical disorders.
  - Abnormalities that involve lipids, carbohydrates, proteins, vitamins, and fluid are considered internal causes of disease and part of the metabolic causes.
Patient care

• What major steps can be considered for the care of the patient?
  - History taking, physical examinations, and laboratory tests.
  - Care of the patient has a major goal and that is to provide the expected outcome of a disease called its prognosis.
  - Patient care is not only important for the presented patient of disease case, but also serves in future prevention method for the same or different disease.
The pain is over for now 😊

I used to have Mad Cow's disease, but I'm alright Noooooooooow.