General Pathology

Introduction

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Introduction to Pathology:

Pathology is the study *(logos)* of disease *(pathos)*. More specifically, it is devoted to the study of the structural, biochemical, and functional changes in cells, tissues, and organs that underlie disease.
By the use of molecular, microbiologic, immunologic, and morphologic techniques, pathology attempts to explain the whys and wherefores of the signs and symptoms manifested by patients while providing a rational basis for clinical care and therapy.
Traditionally the study of pathology is divided into:

1- **General** pathology: which is concerned with the reactions of cells and tissues to abnormal stimuli and to inherited defects, which are the main causes of disease, and

2- **Systemic** pathology: which examines the alterations in specialized organs and tissues that are responsible for disorders that involve these organs.
The four aspects of a disease process that form the core of pathology are:

1- Its cause *(Etiology)*.

2- The mechanisms of its development *(Pathogenesis)*.

3- The biochemical and structural alterations induced in the cells and organs of the body *(Molecular and Morphologic Changes)*, and

4- The functional consequences of these changes *(Clinical Manifestations)*.
Etiology or Cause:

There are two major classes of etiologic factors:

1- **Genetic** (e.g., inherited mutations and disease-associated gene variants, or polymorphisms) and

2- **Acquired** (e.g., infectious, nutritional, chemical, physical).
Most of our common afflictions, such as atherosclerosis and cancer, are multifactorial and arise from the effects of various external triggers on a genetically susceptible individual. The relative contribution of inherited susceptibility and external influences varies in different diseases.
Pathogenesis:

Refers to the sequence of events in the response of cells or tissues to the etiologic agent, from the initial stimulus to the ultimate expression of the disease.

The study of pathogenesis remains one of the main domains of pathology.

Even when the initial cause is known (e.g., infection or mutation), it is many steps removed from the expression of the disease.
Molecular and Morphologic Changes

Morphologic changes refer to the structural alterations in cells or tissues that are either characteristic of a disease or diagnostic of an etiologic process. The field of diagnostic pathology has expanded to encompass molecular biologic and immunologic approaches for analyzing disease states.
**Functional Derangements and Clinical Manifestations**

The end results of genetic, biochemical, and structural changes in cells and tissues are functional abnormalities, which lead to the clinical manifestations (symptoms and signs) of disease, as well as its progress (clinical course and outcome).
Virtually all forms of disease start with molecular or structural alterations in cells, a concept first put forth in the nineteenth century by Rudolf Virchow, known as the father of modern pathology.
We therefore begin our consideration of pathology with the study of the causes, mechanisms, and morphologic and biochemical correlates of cell injury.

Injury to cells and to extracellular matrix ultimately leads to tissue and organ injury, which determine the morphologic and clinical patterns of disease.
Pathology serves as the bridge between the basic sciences and clinical medicine, and is the scientific foundation for all of medicine. Thus, In this course of general pathology we will try to interpret and understand the dysfunctions of a cell, tissue and organs.
In the first chapter we discuss first how cells adapt to stresses, and then the causes, mechanisms, and consequences of the various forms of acute cell damage, including reversible cell injury, and cell death.

We conclude with three other processes that affect cells and tissues: intracellular accumulations, pathologic calcification, and cell aging.
In the second chapter we will study acute and chronic inflammation.

This chapter describes the sequence of events and mediators of acute inflammation, and then its morphologic patterns.

This is followed by a discussion of the major features of chronic inflammation.

Inflammation has a rich history, and we first touch on some of the historical highlights in our consideration of this fascinating process.
The third chapter is: **Tissue Renewal, Regeneration, and Repair**.

In this chapter we first discuss the principles of cell proliferation, the proliferative capacity of tissues, and the role of stem cells in tissue homeostasis. This is followed by an overview of growth factors and cell signaling mechanisms relevant to healing processes.
We then discuss regenerative processes with emphasis on liver regeneration, and examine the properties of the ECM and its components. These sections lay the foundation for the consideration of the main features of wound healing and fibrosis.
The chapter 4 is:

**Hemodynamic Disorders, Thromboembolic Disease, and Shock.**

Here, we focus on disorders of hemodynamics (edema, congestion, and shock) and hemostasis (hemorrhage and thrombosis), as well as various forms of embolism. Diseases that primarily affect the blood vessels and the heart will be discussed later in the course of systemic Pathology.
Chapter 5 – Genetic Disorders

We begin our discussion with a description of mutations that affect single genes, since they underlie Mendelian disorders.

We follow with transmission patterns and selected samples of single gene disorders.

It is, however, important to clarify several commonly used terms:

hereditary, familial, and congenital.
Chapter 6 – Diseases of the Immune System
This chapter is devoted to diseases caused by too little immunity or too much immunologic reactivity.
We also consider amyloidosis, a disease in which an abnormal protein, derived in some cases from fragments of immunoglobulins, is deposited in tissues.
First, we review some of the important features of normal immune responses, to provide a foundation for understanding the abnormalities that give rise to immunological diseases.
Chapter 7 – Neoplasia

The discussion that will be in this chapter deals with both **benign** and **malignant** tumors, focusing on the basic morphologic and biologic properties of tumors and the molecular basis of **carcinogenesis**. We also discuss the interactions of the tumor with the host and the host response to tumors.
Chapter 8 – Infectious Diseases

Infectious diseases remain an important health problem worldwide.

In the United States, 2 of the top 10 leading causes of death are infectious diseases (pneumonia and influenza, and septicemia).

In developing countries, unsanitary living conditions and malnutrition contribute to a massive burden of infectious diseases that kills more than 10 million people each year. Most of these deaths are among children, especially from respiratory and diarrheal infections.
This chapter focuses on the discussion of the general principles of the pathogenesis and pathology of infectious disease.

Then we will turn to descriptions of specific infections caused by viruses, bacteria, fungi, and parasites. In this discussion we emphasize pathogenic mechanisms and pathologic changes, rather than details of clinical features, which are available in clinical textbooks. Infections that typically involve a specific organ are discussed in other chapters.
Chapter 9 – Environmental and Nutritional Diseases.

In this chapter, we first consider two key issues in global health: the global burden of disease, and the emerging problem of the health effects of climate change.

We then discuss the mechanisms of toxicity of chemical and physical agents, and address specific environmental disorders, including those of nutritional origin.
Chapter 10 – Diseases of Infancy and Childhood.

Children are not merely little adults, and their diseases are not merely variants of adult diseases.

Many childhood conditions are unique to, or at least take distinctive forms in, this stage of life and so are discussed separately in this chapter. Diseases originating in the perinatal period are important in that they account for significant morbidity and mortality.
Each stage of development of the infant and child is prey to a somewhat different group of disorders.

The data available permit a survey of four time spans:
(1) the neonatal period (the first 4 weeks of life),
(2) infancy (the first year of life),
(3) age 1 to 4 years, and
(4) age 5 to 14 years.
Congenital anomalies, disorders relating to short gestation (prematurity) and low birth weight, and sudden infant death syndrome (SIDS) represent the leading causes of death in the first 12 months of life.

In the next two age groups—1 to 4 years and 5 to 14 years—injuries resulting from accidents have become the leading cause of death.

Among the natural diseases, in order of importance, congenital anomalies and malignant neoplasms assume major significance.
Thank you

Next lecture

Cellular Responses to Stress and Toxic Insults: Adaptation, Injury, and Death