



# Pathology

Sheet

Slide



## number

1

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## **Pathology 1- Marwan**

- ✓ What's the importance of studying Pathology?
- ✓ To be able to understand what's abnormal, we should know the normal structure and function.

### **Definition of Pathology:**

Bridging discipline involving both basic science and clinical practice.

- ◆ patho: abnormal state ( disease).
- ◆ logoy: the study.

The study of the abnormal state / the study of disease.

### **Definition of disease:**

Abnormal state of health.

- ✓ Having a certain disease, we have an expression of discomfort due to structural or functional abnormality.
- ✓ Structure is always related function, whenever there is a change in the structure it will be reflected on the function.

### **Classification of diseases:**

- Physical / Mental
- Acute / Chronic
- Acute – short, days to weeks.
- Chronic – long, months to years.

Examples:

- Congenital / Acquired
- Genetic / Environmental
- Mild / Moderate / Severe
- Inflammatory (caused by inflammation) / Neoplastic (caused by tumor) / Degenerative(deterioration in the structure /organ which affects the function due to the use of this organ or aging) / traumatic(usually for the CNS).

### **Aspects of disease process:**

- 1- Epidemiology: the study of incidence of a certain disease in a given population.
- 2- Etiology: the study of the cause or origin of diseases.
- 3- Pathogenesis: the mechanism of the development of diseases.
- 4- Morphological changes: the changes in structure or shape.
- 5- Clinical significance: functional consequences of morphological changes that are represented by signs (what doctors see) and symptoms (what the patient tells us).
  - ✓ The signs could be symptoms and vice versa.
  - This will help us in:
    - Diagnosis
    - Management
    - Prevention of complications
    - Prognosis
    - Prevention

### **Morphological changes:**

- 1- Anatomic: macroscopic (seen with naked eye).
- 2- Microscopic: seen only under microscope.

### **Diagnosis:**

How is the diagnosis process done?

- 1- Patient history should be known first.
- 2- Physical examination:
  - inspection: to see the general state of the patient .
  - Palpation
  - Percussion: there are two different sounds:
    - 1- Resonant (when space exist).
    - 2- Dull (in the solid place)
  - Auscultation (typically with a stethoscope).
- 3- Investigation(testing): like CBC (complete blood count) , X-ray...
- 4- If we have another abnormality (i.e. mass) we should take a biopsy.

The tables in the slides 27-28. (plasia means growth not disorder of growth).

# Cell injury

The causes of cell injury are same causes of diseases.

## The causes of cell injury:

- 1- Physical: trauma, thermal (heat or cold), radiation.
- 2- Chemical: drugs, toxicants, smoking.
- 3- Infectious.
- 4- Immunological: autoimmune (the antigen is in our body), anaphylactic (the antigen is from the outer environment).
- 5- Nutritional: overnutrition or undernutrition.
- 6- Genetic
- 7- Oxygen Deprivation :
  - ◆ Hypoxia: is the most common cause of cell injury.
  - ◆ The most common cause of oxygen deprivation is ischemia.
  - ◆ Ischemia: the reduction of blood flow.
- 8- Aging

## Two types cell death:

- 1- Apoptosis: programmed cell death which can either be physiological or pathological.
- 2- Necrosis: always pathological.

## Causes of hypoxia:

- 1- Ischemia
- 2- Respiratory failure
- 3- High places
- 4- Anemia

## Cellular aging mechanisms:

INTRINSIC: genetic factors.

EXTRINSIC: environmental factors.

Each cell in the human body is approximately exposed to 1,000,000 damages and each damage is supposed to be repaired. However, with aging, the ability to repair decreases which leads to the accumulation of damages leading to cell death.

- ✓ Cellular responses to injurious stimuli depends on the type (the type of the cell and the type of the injurious stimuli), duration, and severity of injury.

**The targets for cell injury (what does cell injury affect?):**

- 1- Cell membrane integrity (structure and function)
- 2- ATP generation (the mitochondria)
- 3- Protein synthesis (the ribosomes in the RER)
- 4- Integrity of the genetic apparatus (the nucleus)

**Cellular & biochemical mechanisms:**

- 1- Loss of membrane integrity.
- 2- ATP depletion and mitochondrial damage (all the functions of the cell that depend on energy will be lost, e.g. pumps)
- 3- Increase of intracellular calcium (calcium will activate all the inactive enzymes and will begin to destroy the cell and the cell organs)  
Normally, extracellular calcium is higher than intracellular calcium by 10,000 times.

The enzymes that will be activated:

- Protease: destroys the cytoskeleton and membrane.
  - ATPase: reduce ATP.
  - Endonuclease: nucleus chromatin damage (cleaves the phosphodiester bond within a polynucleotide chain).
  - Phospholipase: breakdown of phospholipids (membrane damage).
- 4- Free radical-induced injury:
    - They are unstable chemical substances that are produced by cells and once their job has been done, they will disappear or decay.
    - They exit from the cell and the component and affect the same cell and the same component.
  - 5- Protein breakdown: all functions that depend on proteins will be affected, like: enzymes, receptors, carrying capacity (the proteins that are carriers of lipids). Since the carrying capacity will be less, lipids will accumulate in the liver leading to Cirrhosis of the liver.
  - 6- DNA damage: it's related to protein breakdown and affects the synthesis of proteins.