Pathology Lec1 Summary (Cell injury, death, and adaptations)

General Overview

- Cells have internal compartments with specific functions that are regulated and maintained constant (homeostasis) to adapt with different stresses and demands from the surrounding environment.
- Cellular Adaptation is changes (increase/decrease) in the cell number, size, type, and accordingly the cell's function.
- Any stress would first cause cell adaptation, then it'll progress to reversible cell injury, further progression to irreversible cell injury meaning cell death which is either necrosis or apoptosis.

  (Adaptation→reversible injury→ irreversible injury (death)
- stress can directly cause cellular injury if the stimulus is injurious.

Adaptation

- Types depending on the cause:
  1.physiologic (physiologic change). 2.pathologic (disease).
- Forms/mechanisms of Adaptation:
  1-increase in cell size (hypertrophy).
  2-increase in cell number (hyperplasia).
  3-decreased in cell size (atrophy)
  4-change in cell type.

Hyperplasia

- increased in cell **number** in tissues that have a proliferative ability.
- Can be pure or mixed.
- Types:
  1-Physiologic:
  A. hormonal stimulation e.g. hyperplasia in breast glandular tissue (puberty or pregnancy).
  B. compensatory e.g. liver hyperplasia after liver resection.

2-Pathologic: (give arise to cancer)

A. Excessive hormonal stimulation:

e.g. endometrial hyperplasia due to continuous **estrogen** stimulation, benign prostatic hyperplasia caused by hyper **androgenic** stimulation.

*endometrial hyperplasia causes endometrial carcinoma (cancer)

B. Viral infections e.g. warts caused by HPV virus.

Metaplasia

- change in cell **types** by reprogramming stem cells to differentiate into a new cell type (Reversible process)
- Examples:

  A. changes in respiratory epithelium that lines the bronchi from ciliated pseudostratified into squamous.

  B. epithelium that lines the esophagus changes from squamous to glandular in GERD.

  *esophageal metaplasia causes esophageal carcinoma (cancer)
- Causes:

  1-smoking. 2-vitamin A deficiency. 3-GERD (gastroesophageal reflux disease)

Hypertrophy	vs.	**Atrophy**
increase in cell size and functional capacity by increasing the production of structural proteins and organelles.		**decrease** in cell size and function by 1)decreasing in protein synthesis 2)increase in protein degradation and 3)autophagy.
1.physiologic (hormonal, growth factor stimulation or increased functional demand). 2.pathologic		1.physiologic: e.g. endometrial atrophy caused by loss in hormone stimulation in menopause. 2.pathologic: caused by denervation injury, or chronic ischemia resulted from arteriosclerosis or diabetes.
Can be: 1.pure (happens in cells that can't divide like cardiac, skeletal muscles) 2.Mixed (accompanied with hyperplasia)		Causes: 1.decrease workload. 2. loss of innervation. 3.diminished blood supply (ischemia). 4.inadequate nutrition. 5.loss of endocrine stimulation. 6.aging.

Hypertrophy Examples

Heart (cardiac muscles)		Uterus (smooth muscles)	Skeletal muscles
Pure		Mixed (accompanied with hyperplasia)	Pure
Types	Pathologic: Hypertension aortic valve stenosis	Physiologic: Estrogenic stimulation during pregnancy	Physiologic
impact	Can cause irreversible cell injury if untreated, resulting in myocardium degeneration due to lack of blood supply which leads to heart failure, ischemia, or myocardial infarction.	Reversible cell injury: Once the stress/demand is relieved	
Side notes	Purpose of hypertrophy: Increase the force of contraction.	-	-

Cell Injury Causes

ischemia leads to hypoxia
→lack of blood leads to lack of O_2

1.Oxygen deprivation (Hypoxia) by:

A. Ischemia (lack of blood due to artery blockage by a clot)

B. Pulmonary diseases: pulmonary hypertension, emphysema (obstructive pulmonary disease).

2.Chemical Agents (sugar, drugs, pesticides, and insecticides)

3.Infectious Agents (viruses, bacteria, protozoa parasites, worms)

4.Immunologic Reactions (Autoimmune, microbes, allergic rxns: rhinitis, conjunctivitis, eczema)

5.Genetic factors (chromosomal and gene mutations)

6.Nurtitional Imbalances (excess nutrition or malnutrition)

7.Physical Agents (trauma, extreme temp., electric shock)

8.Age

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