



Pathology – Cell Injury

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Cell Injury

- Cell injury is defined as a variety of stresses a cell encounters as a result of changes in its internal and external environment.
- Various forms of cellular responses to cell injury
 - (cellular adaptations)
 - (reversible cell injury)
 - (irreversible cell injury)

Cell Death

- **APOPTOSIS** (“normal” death)
 - Good for the body
- **NECROSIS** (“premature” or “untimely” death due to “causes”)

PATHOGENESIS

“sequence of events from the initial stimulus to the ultimate expression of the disease”

ETIOLOGY OF CELL INJURY

- 1. Hypoxia and ischemia
- 2. Physical agents
- 3. Chemical agents and drugs
- 4. Microbial agents
- 5. Immunologic agents
- 6. Nutritional derangements
- 7. Aging

Causes of cell injury

1. HYPOXIA AND ISCHAEMIA :

- Cells of different tissues essentially require oxygen to generate energy and perform metabolic functions
- Deficiency of oxygen or hypoxia results in failure to carry out these activities
- The most common mechanism of hypoxic cell injury is by reduced supply of blood to cells due to interruption i.e. ischemia.

2. PHYSICAL AGENTS.

- mechanical trauma (e.g. road accidents);
- thermal trauma (e.g. by heat and cold);
- electricity;
- radiation (e.g. ultraviolet and ionising): and

Causes of cell injury

3. CHEMICALS AND DRUGS

- chemical poisons such as cyanide, arsenic, mercury;
- strong acids and alkalis;
- environmental pollutants;
- insecticides and pesticides;
- alcohol and narcotic drugs

4. MICROBIAL AGENTS

- Injuries by microbes include infections caused by bacteria, rickettsia, viruses, fungi, protozoa, metazoa, and other parasites

Causes of cell injury

5. IMMUNOLOGIC AGENTS:

- hypersensitivity reactions;
- anaphylactic reactions; and
- autoimmune diseases

6. NUTRITIONAL DERANGEMENTS

- due to overall deficiency of nutrients (e.g. starvation),
- protein calorie (e.g. marasmus, kwashiorkor),
- minerals (e.g. anaemia)

Cellular Adaptations

- For the sake of survival on exposure to stress, the cells make adjustments with the changes in their environment or adapt
 - to the physiologic needs (physiologic adaptation) and
 - to non-lethal pathologic injury (pathologic adaptation)

Example of Cellular Adaptations

Remember 3 Plasia – 2 trophy Brothers

Plasia Means : **Number**

Trophy means: **size**

Hyperplasia, Dysplasia, Metaplasia

Atrophy, Hypertrophy

Know the definitions of all these terms, for the rest of your life

Atrophy:

Atrophy: Reduction of the number and size of parenchymal cells of an organ

Physiologic atrophy.

Atrophy of lymphoid tissue in lymph nodes, appendix and thymus.

ii) Atrophy of gonads after menopause.

iii) Atrophy of brain with aging.

Pathologic atrophy

Starvation atrophy.

Ischemic atrophy.

Hypertrophy :

Hypertrophy : Increased tissue size via **enlargement of cells** caused by an increase in organelles, and structural proteins

Physiologic Hypertrophy:

Increased muscle mass through sport

Uterus enlargement during the pregnancy

Pathologic hypertrophy

Hypertrophy of cardiac muscle

Hyperplasia :

Hyperplasia : Hyperplasia is an increase in the number of parenchymal cells resulting in enlargement of the organ or tissue

Physiologic Hyperplasia

Hyperplasia of female breast at puberty, during pregnancy and lactation.

Pathologic hyperplasia

Endometrial hyperplasia following estrogen excess

Metaplasia:

Metaplasia: defined as a reversible change of one type of epithelial or mesenchymal adult cells to another type of adult epithelial or mesenchymal cells.

Physiological metaplasia:

Metaplasia of endocervix: columnar epithelium in to squamous epithelium

Pathological metaplasia:

Respiratory epithelium in smokers

Dysplasia:

Dysplasia: Dysplasia means 'disordered cellular development', often accompanied with metaplasia and hyperplasia;

It is therefore also referred to as atypical hyperplasia.

Dysplasia occurs most often in epithelial cells

Epithelial dysplasia is characterized by cellular proliferation and cytologic changes

1. Increased number of layers of epithelial cells
2. Disorderly arrangement of cells from basal layer to the surface layer

Dysplastic changes often occur due to chronic irritation or prolonged



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