University of Mosul
Lecture No.:
College of Veterinary Medicine
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Lecture title: # Cell injury

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Summary:

The normal cell has to handle normal physiological demands (homeostasis), some more excessive physiological stress or some pathological stimuli bring adaptation. If the adaptive capability is exceeded or in certain cases when adaptation is not possible a sequence of regressive changes occurs known as cell injury (degenerative changes or degeneration).

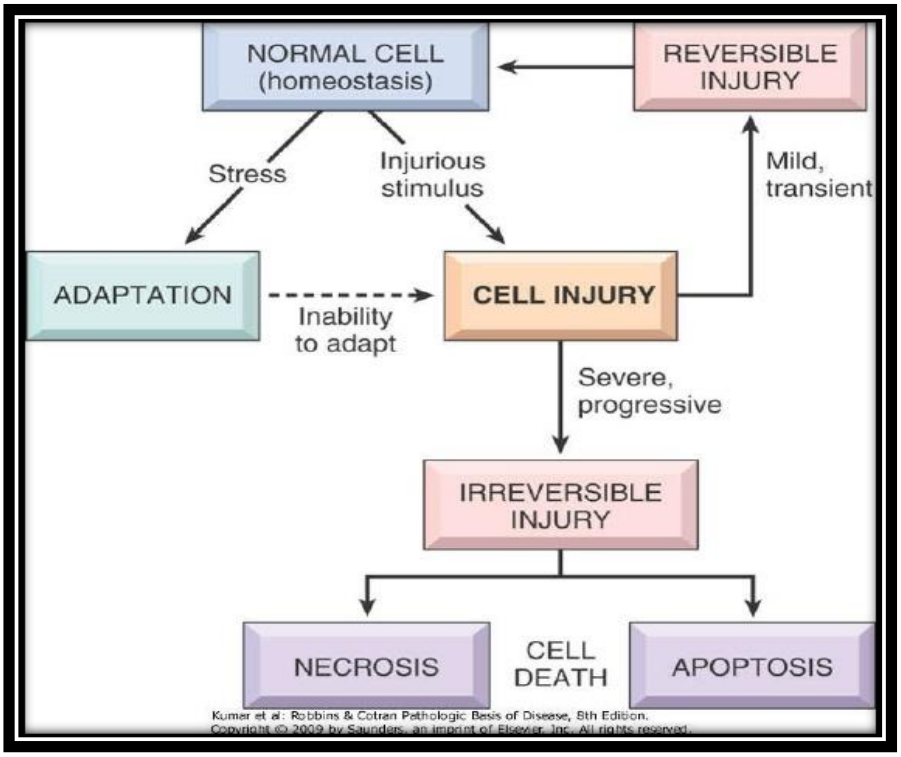

Table 1: pathways of cell injury

Degeneration (Latin word of deterioration):

Degeneration is a reversible biochemical, functional and morphological abnormalities in the cells resulting from any injury not severe enough to cause cell death. It is accumulation of normal (water, protein, carbohydrates and lipids) or abnormal (amyloid) end products of cell in the cytoplasm.

The **nucleus not affected**, but the **changes observed in cytoplasm**. Degeneration is reversible but may be progress to necrosis if the injury persists.

-Degeneration may have many characteristic features:

1- The causes may be within normal limits of physiological adaptation.
2- Some degeneration is only indications of temporary functional changes.
3- In general, degenerative changes consider reversible if the functions return to normal.
4- Some degeneration progress toward death of cell.

- General causes of cell injury:

1. Hypoxia or oxygen deprivation: is a partial reduction in the oxygen supplied to cells or tissue while a complete reduction of oxygen refers to **anoxia.** It is a common cause of cell injury and death. Depending on the severity, cell may be adapted or undergo injury. Oxygen is critically important for oxidative phosphorylation in cell. Hypoxia can result from loss of blood supply **(ischemia)**, inadequate oxygenation of blood due to cardio-respiratory failure and anemia or carbon monoxide toxicity.

2. Physical agents: It includes mechanical trauma, temperature (burns and deep cold), radiation and electric shock.

3. Chemical agents and drugs: Concentrated simple chemicals, toxic substances as arsenic, cyanide or mercuric, alcohol, insecticides, environmental and air pollutants and narcotic drugs.

4. Infectious agents: viruses, bacteria, parasites and fungi.

5. Immunologic reactions.

6. Genetic derangement.

7. Nutritional deficiency.

8. Workload imbalance.

Pathogenesis of cell injury:

The loss of ATP synthesis leads to:

1- Defect in energy dependent ionic pump lead to accumulation of intracellular sodium and diffusion of potassium outside. The earliest results due to the dysfunction of energy depending sodium potassium pump in the plasma membrane resulting in entrance of sodium, calcium and water into the cells which leads to cloudy swelling and hydropic degeneration.

2- The same mechanism leads to swelling of cell organelles.

3- Switch to anaerobic metabolism, which lead to production of lactic acid and decrease pH.

4- Chromatin clumping and disruption of organelle membranes then occur which lead to release of lysosomal enzyme into the cytoplasm and damage vital intracellular molecules.

5- Plasma membrane damages and impaired its functions lead to: Loss of structural integrity, which lead to rupture and necrosis of the cell **(irreversible damage)**, while less severe lead to localized **(reversible damage)**.

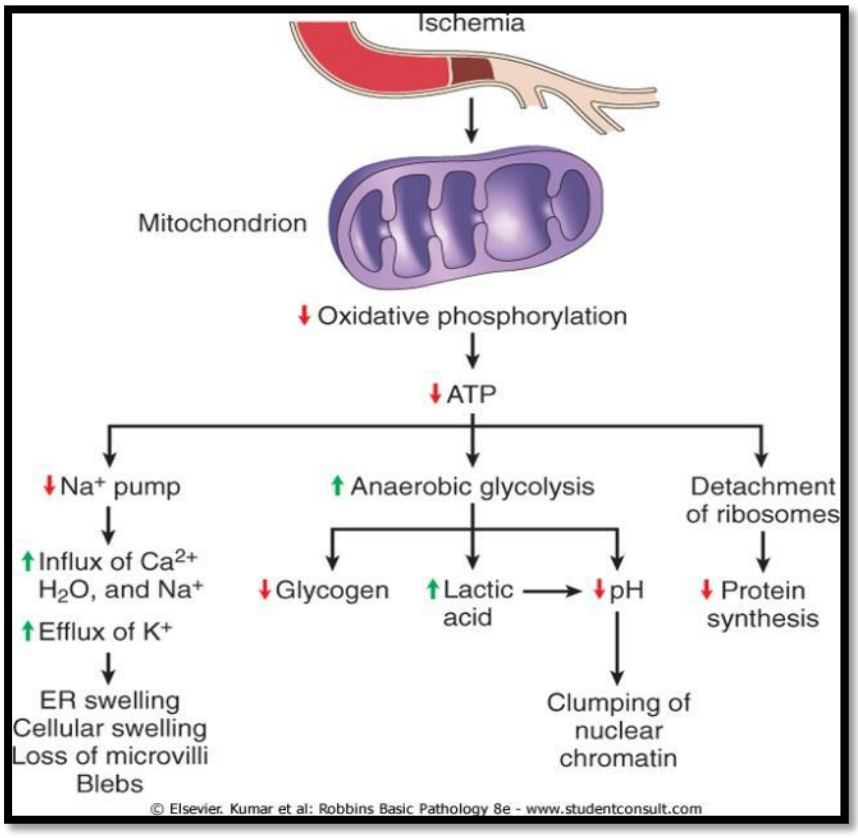

Table 2: Pathogenesis of cell injury