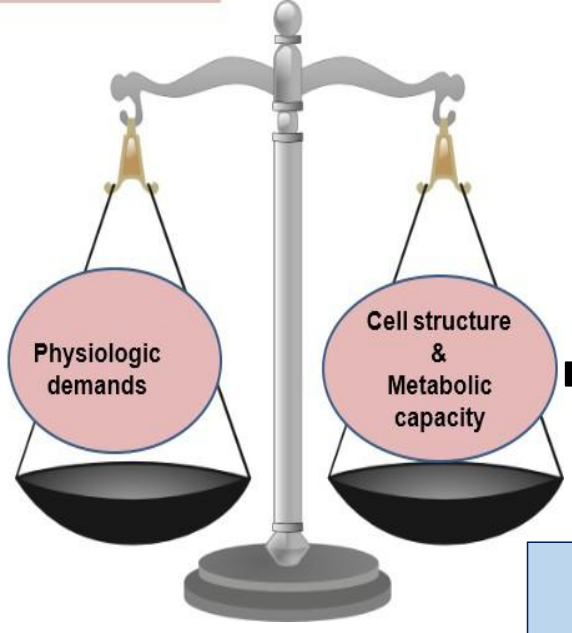
CELL INJURY-1

ILOs:

By the end of this lecture, students should be able to:

1. Define cellular injury and explain the types
2. List the causes of cellular injury
3. Explain the pathogenesis of reversible and irreversible cell injury due to hypoxia- ischemia
4. List the ultra-stuctural changes during cell injury due to hypoxia- ischemia
5. Discuss radical induce injury

DR.SAJDA GAJDHAR
GENERAL PATHOLOGY



Injurious stimulus

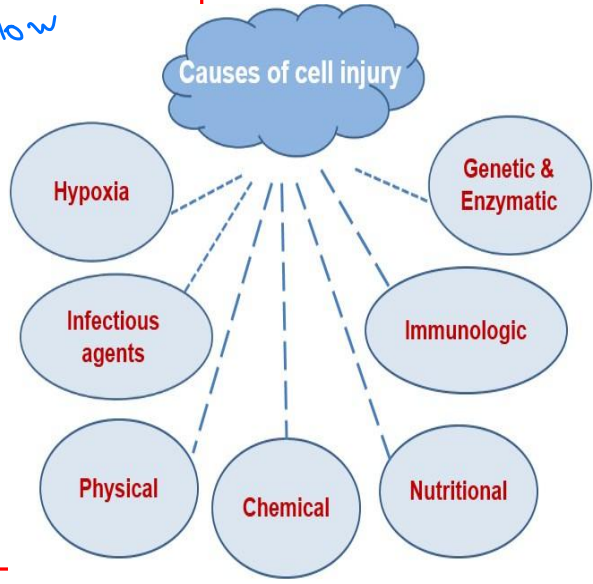
Homeostasis

Cell injury

Cell injury is defined as the **functional and morphologic effects** of **a variety of stresses due to etiologic agents** a cell encounters resulting in changes in its **internal & external environment**.

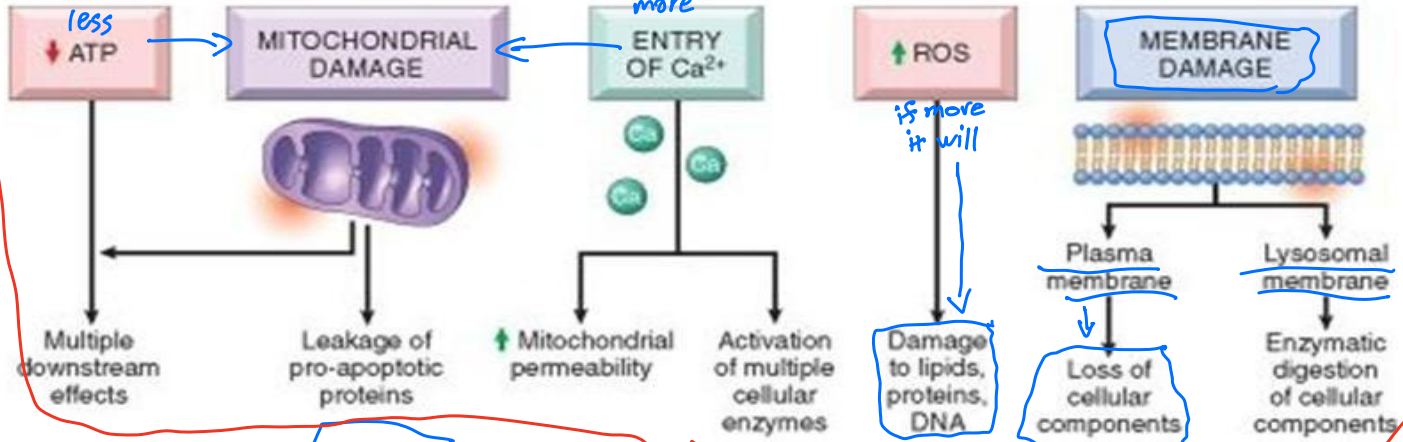
Causes of Cell injury

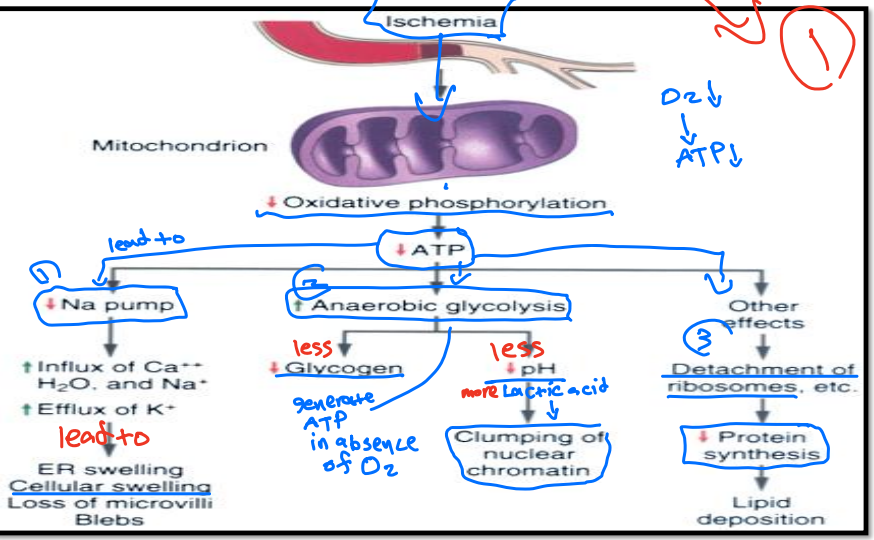
1. **Hypoxia:** Is a main cause in cell injury Decrease oxygen supply is caused by:
   a. Ischemia e.g. arterial occlusion and atherosclerosis
   b. Inadequate oxygenation e.g. pulmonary disease
   c. Decreased oxygen carrying capacity of the blood e.g. anemia
2. **Infectious agents:** Viruses, bacteria, fungi and parasites.
3. **Physical agents:** heat, irradiation and electric shock.
4. **Chemical agents & Drugs:** Acids, alkalies & poisons.
5. **Immunological reactions:** Autoimmune diseases.
6. **Nutritional disturbances.**
7. **Genetic & Enzymatic disorders.**

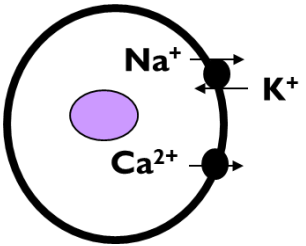


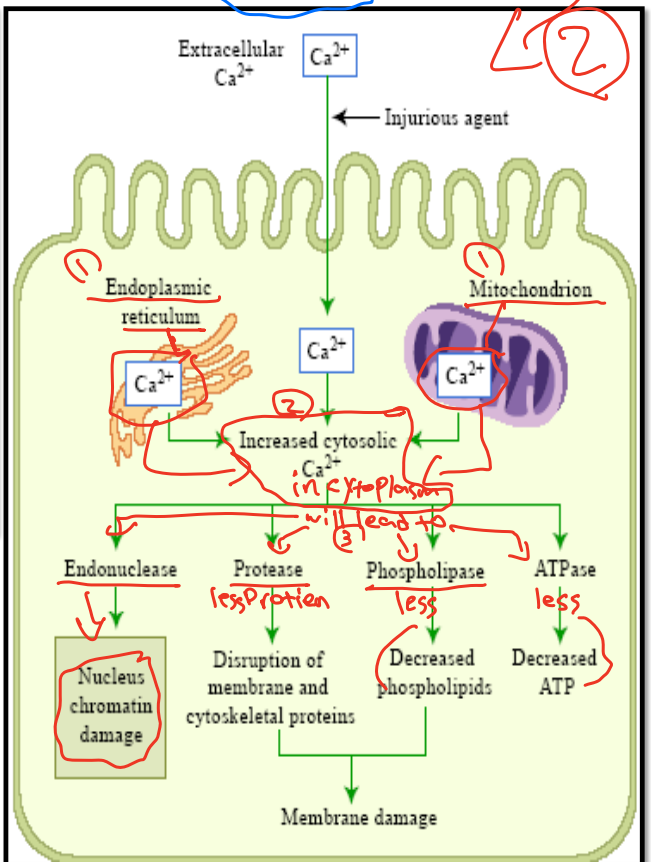
Mechanism (pathogenesis) of Cell injury

1. ATP depletion
2. Permeability of cell membrane
3. Calcium entry: Increased intracellular Ca which activate cellular enzymes
4. Damage of Mitochondria
5. Free radicals formation

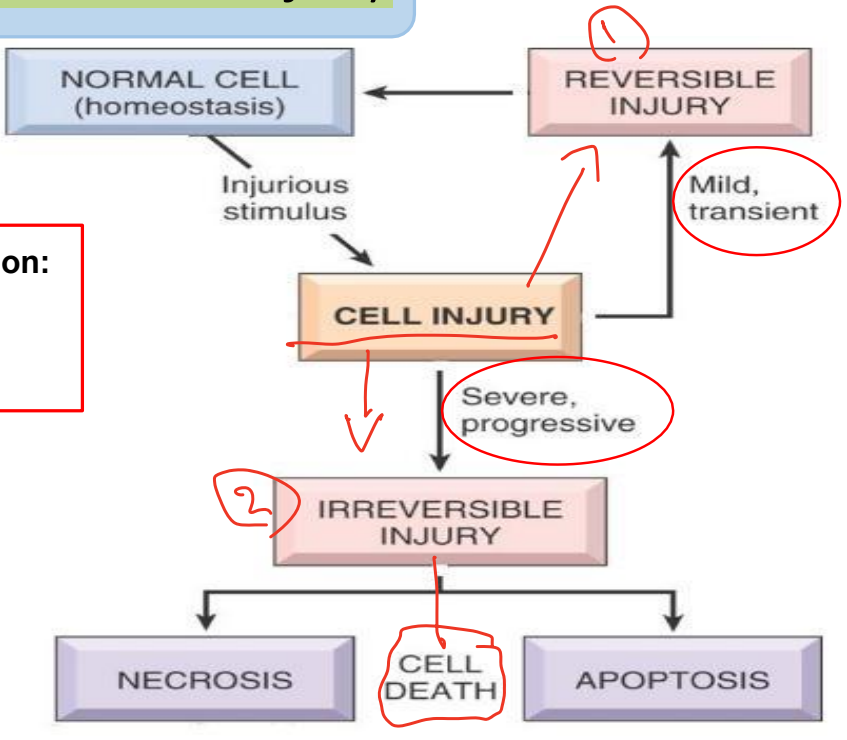



Ischemia
Mitochondrion
Oxidative phosphorylation
ATP
Na pump
Anaerobic glycolysis
Other effects
Influx of Ca++ H2O, and Na+
Efflux of K+
ER swelling
Cellular swelling
Loss of microvilli
Blebs
Glycogen
pH
Clumping of nuclear chromatin
Detachment of ribosomes, etc.
Protein synthesis
Lipid deposition


Na+
K+
Ca2+


Extracellular Ca2+
Injurious agent
Endoplasmic reticulum
Mitochondrion
Increased cytosolic Ca2+
Endonuclease
Protease
Phospholipase
ATPase
Nucleus chromatin damage
Disruption of membrane and cytoskeletal proteins
Decreased phospholipids
Decreased ATP
Membrane damage

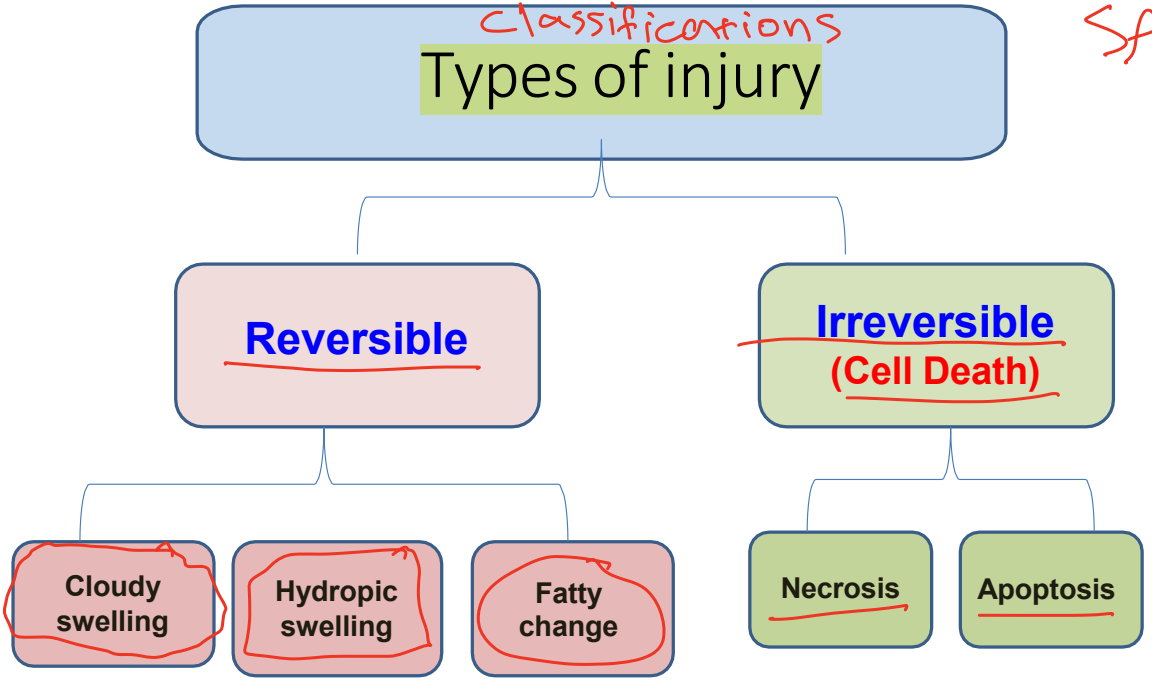
Types of cell injury



The effects of cell injury depend upon:

1- Severity of injurious agent

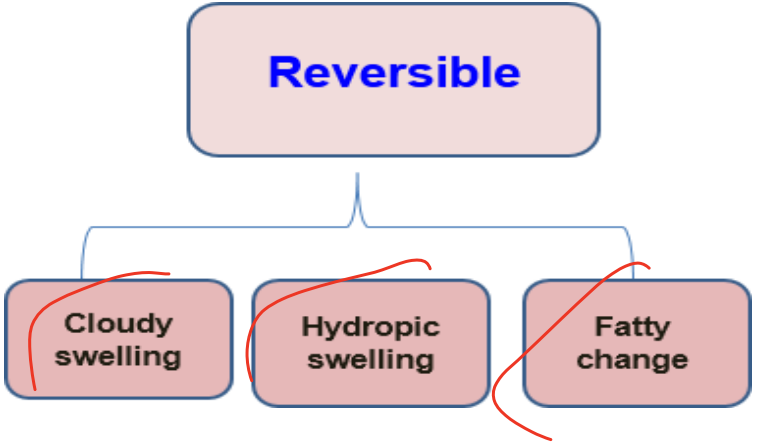
2- Duration of injurious agent.


classifications
Types of injury
SAQ
Reversible
Irreversible
(Cell Death)
Cloudy swelling
Hydropic swelling
Fatty change
Necrosis
Apoptosis

1 Reversible cell injury

Reversible cell injury: Alterations in cell function and structure, which are correctable if the damaging stimulus is removed. Occur in mild & transit forms of injury.

Form: it has 3 form



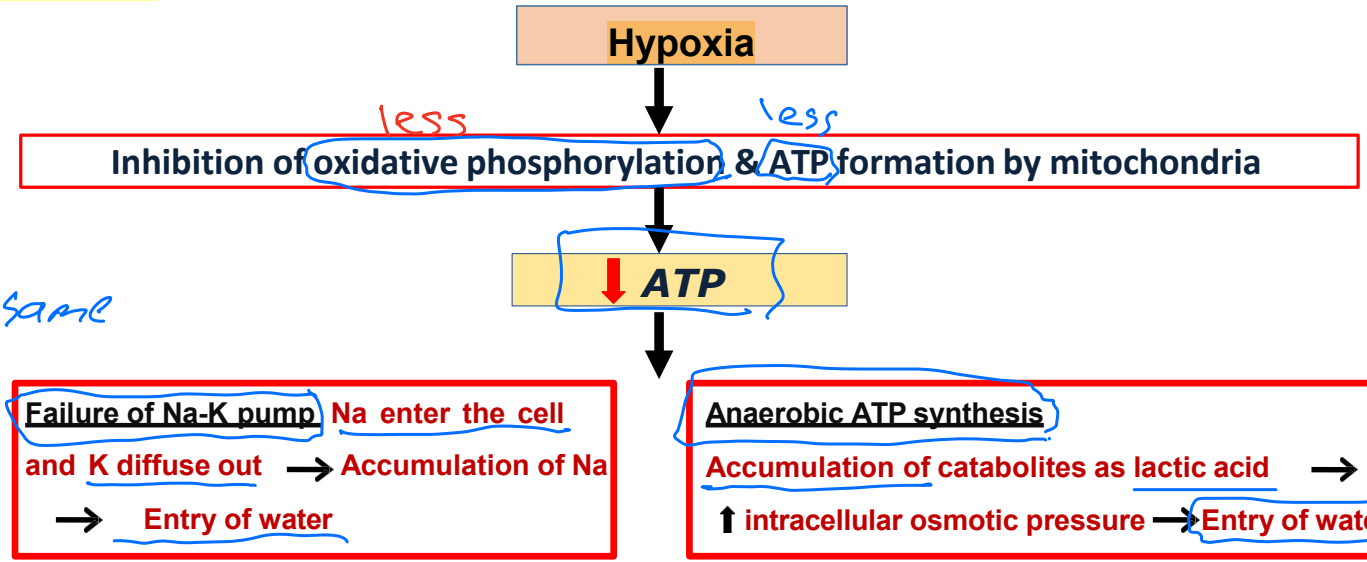
1- Cloudy Swelling

Definition: Reversible cell injury characterized morphologically by

1 Swelling of the cells

2 Granularity of the cytoplasm (due to water accumulation).

Pathogenesis:



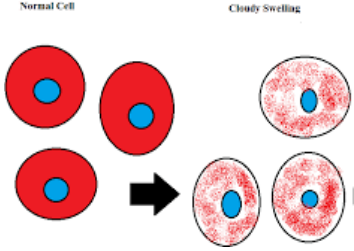
Pathological picture:

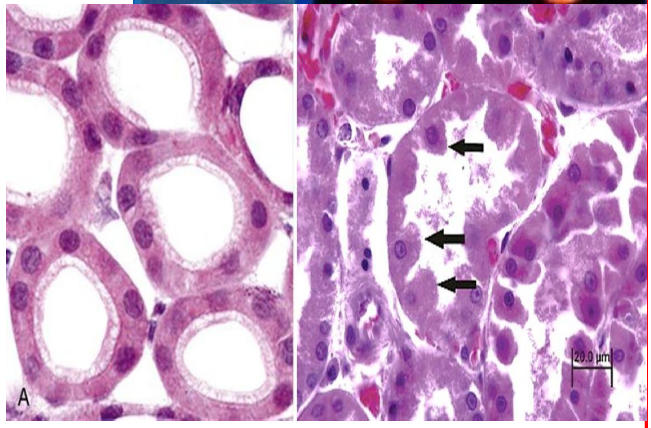
Gross picture: Affected organ showed:

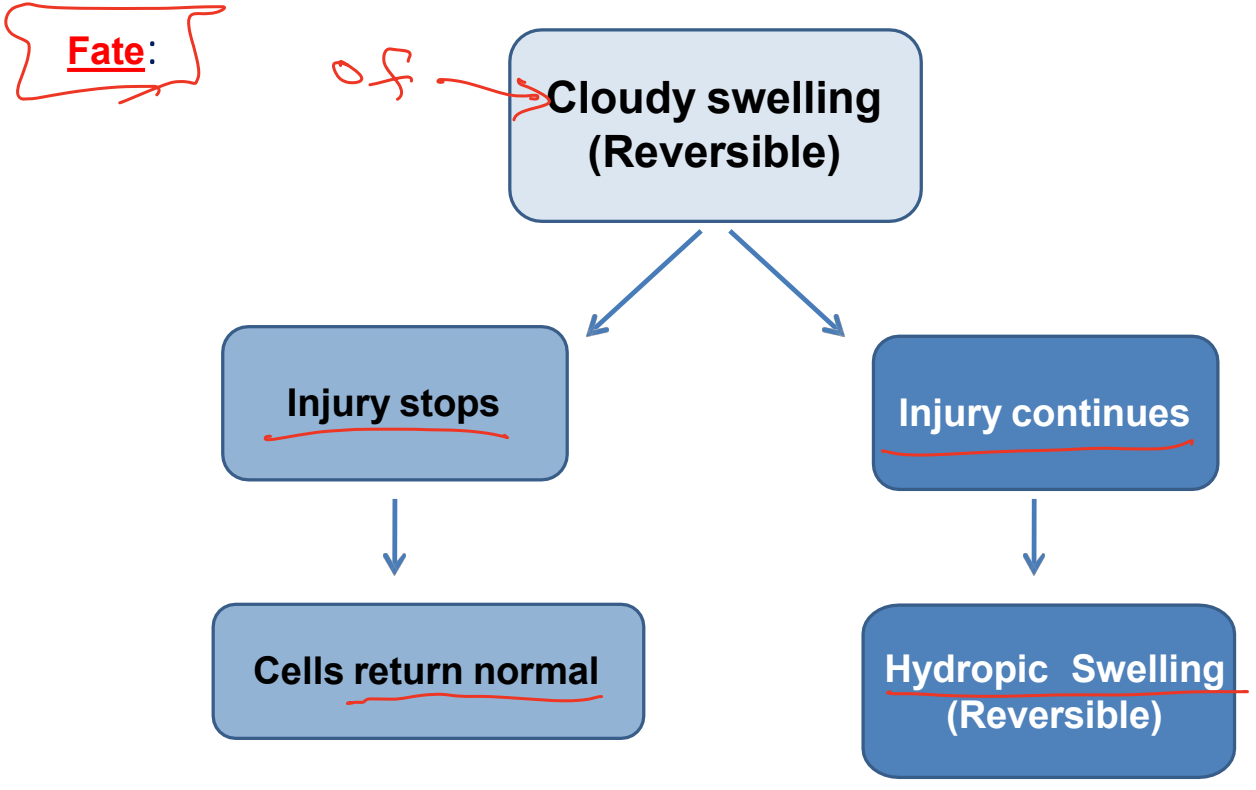
- ***Size:*** Enlarged and swollen
- ***Color:*** Pale (due to compression of the capillaries by the swollen cells)
- ***Consistency:*** Soft
- ***Weight:*** Heavy

Microscopic picture:

- ***Cells :*** Swollen
- ***Cytoplasm:*** Red Fine granular
- ***Nucleus:*** Normal






Fate:
of
Cloudy swelling
(Reversible)
Injury stops
Injury continues
Cells return normal
Hydropic Swelling
(Reversible)

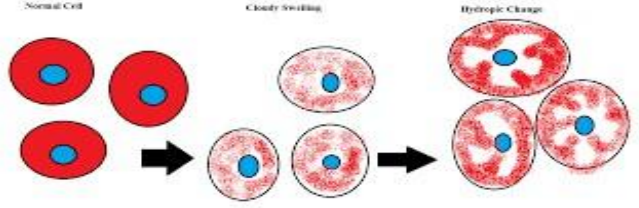
2- Hydropic Swelling

Definition: Reversible cell injury characterized morphologically by

1 Swelling of the cells

2 Vacuoles in the cytoplasm (due to excess water accumulation).

The lesion is more advanced than cloudy swelling



Pathological picture:

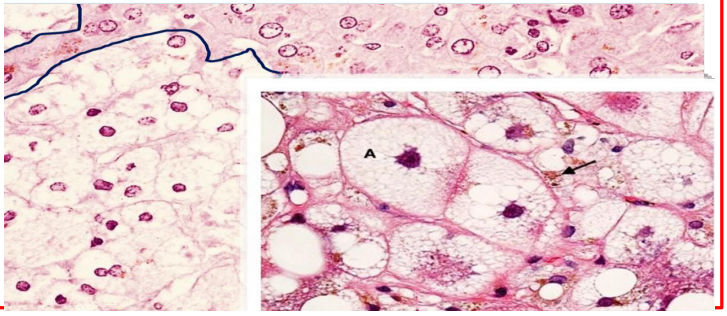
Gross picture: Similar to cloudy swelling

Microscopic picture:

Cells :Swollen

Cytoplasm: Multiple vacuoles

Nucleus: Normal



3- Fatty Change

Definition: Pathological accumulation of excess neutral fat in cells.

Site:

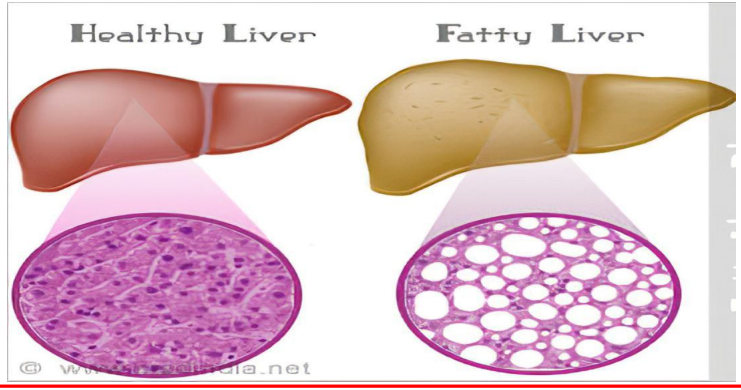
1 liver (common sit) because it is the major organ involved in fat metabolism

2 Heart, muscle, and kidney.

Pathogenesis: Injured cells can not metabolized Fat due to diminished enzyme activity, so it accumulate in cytoplasm

Causes:

1 Alcoholic
2 Obesity
3 Protein malnutrition
4 Diabètes mellites
5 Toxins



Pathological picture:

Gross picture:

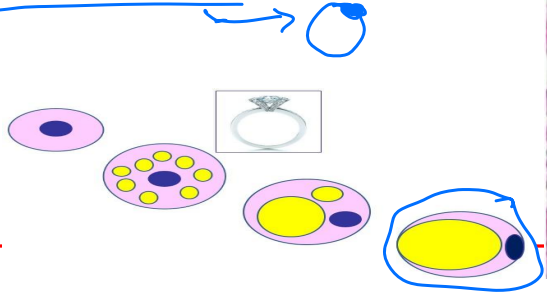
- ***Size:*** Enlarged with tense capsule.
- ***Weight:*** Heavy.
- ***Color:*** pale yellow.
- ***Consistency:*** Soft and greasy .

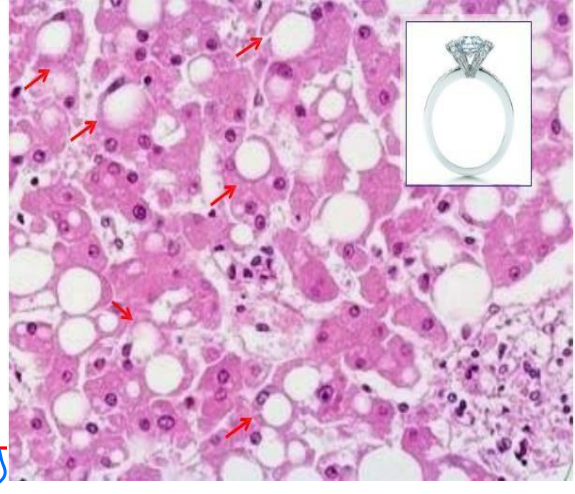
Microscopic picture:

- ***Cells:*** Swollen.

fat is more

-***Cytoplasm:*** accumulation of fat vacuole → push nucleus to periphery giving the signet ring appearance.






thank you