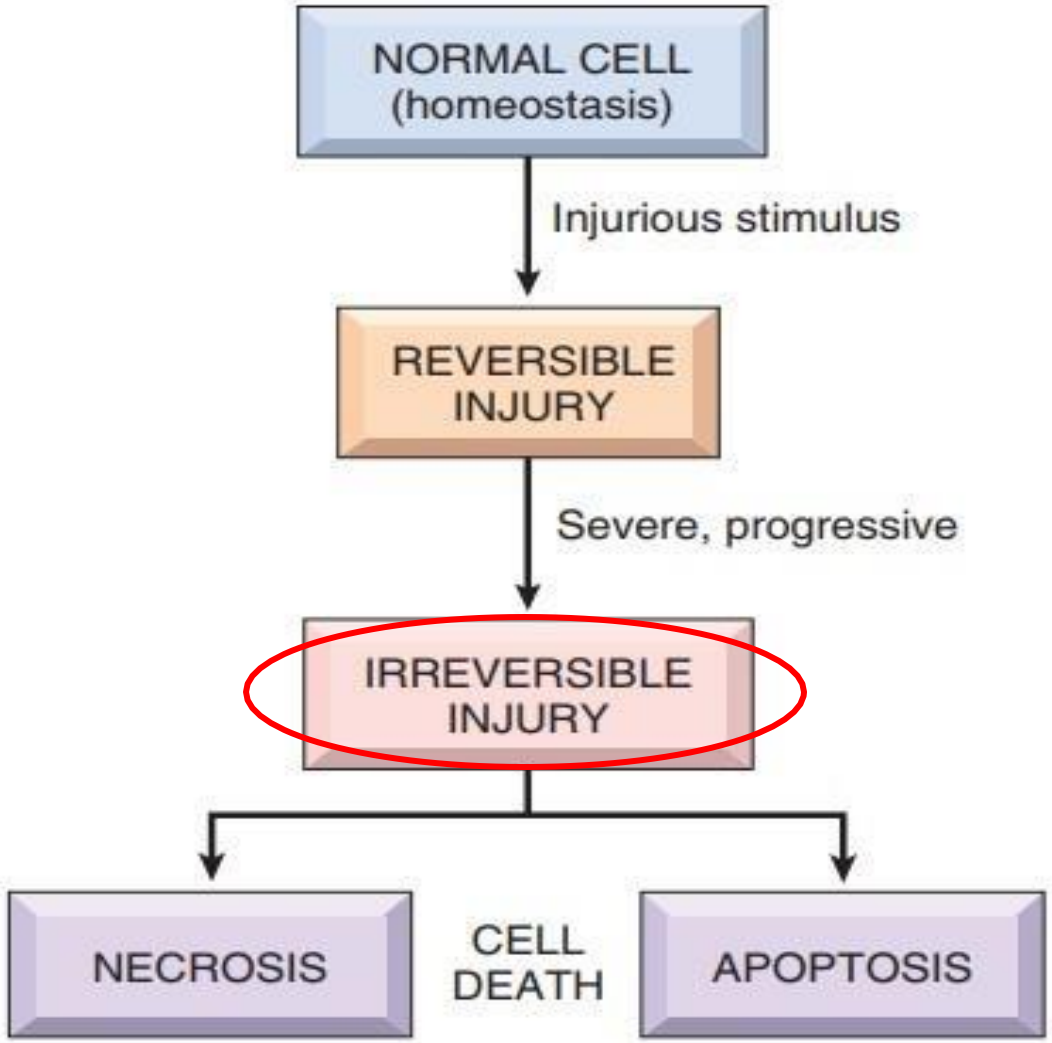
Cell Injury and Necrosis 2

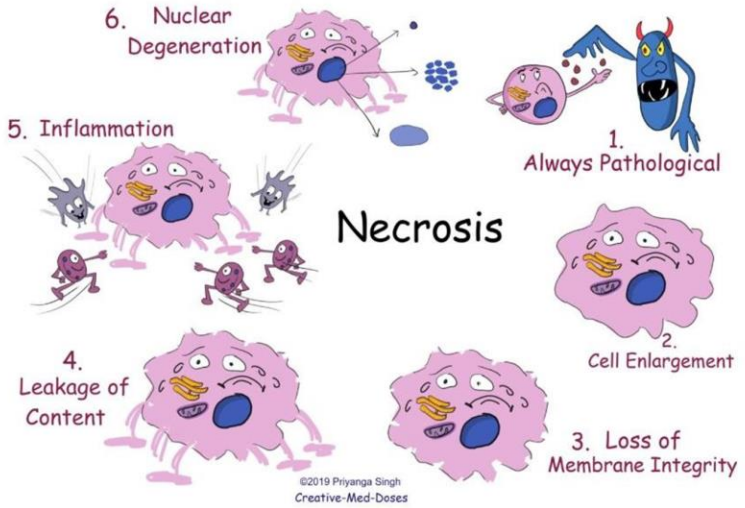
MEDEMIA ACADEMY

Consequences of injury



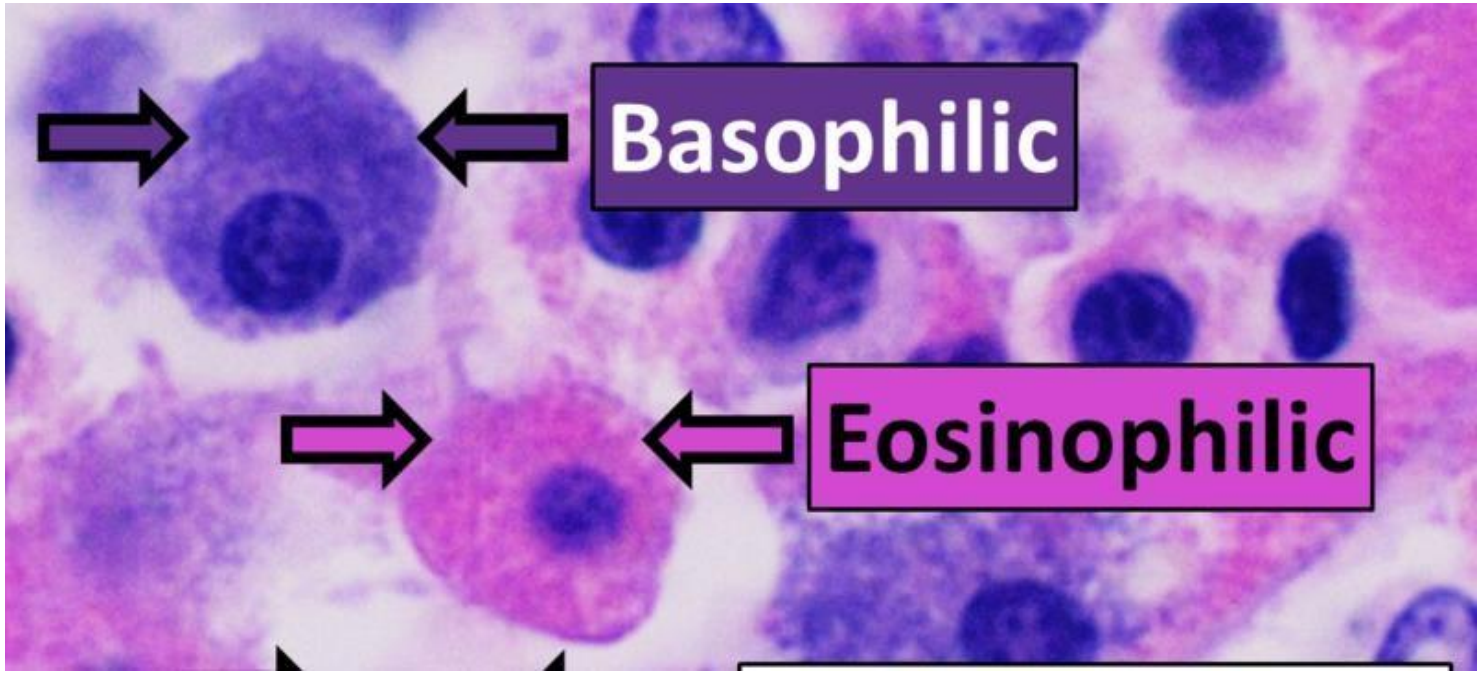
Necrosis

- It is an uncontrolled , accidental , unregulated cell death that results in swelling of the cell organelles, plasma membrane rupture and eventual lysis of the cell, and spillage of intracellular contents into the surrounding tissue leading to tissue damage , Considered as culmination of reversible cell injury that cannot be corrected. And its always pathological
- Usually elicits a local host reaction, inflammation (due to the release of heat shock proteins, uric acid, ATP, DNA, and nuclear proteins).



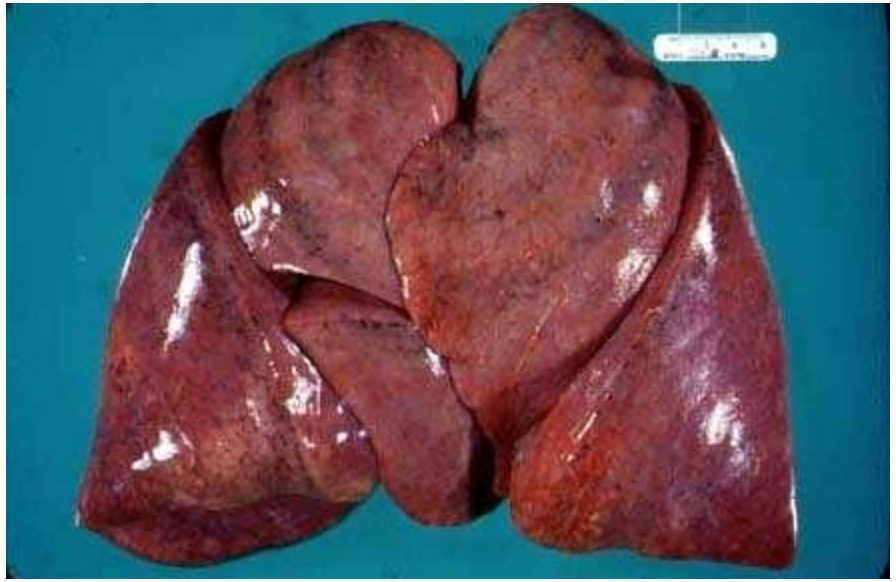
Normal cells in H&E stain

- H&E is the combination of two histological stains: hematoxylin and eosin.
- The hematoxylin stains cell nuclei a purplish blue, and eosin stains the extracellular matrix and cytoplasm pink



Morphological features of necrosis:

1-Grossly :



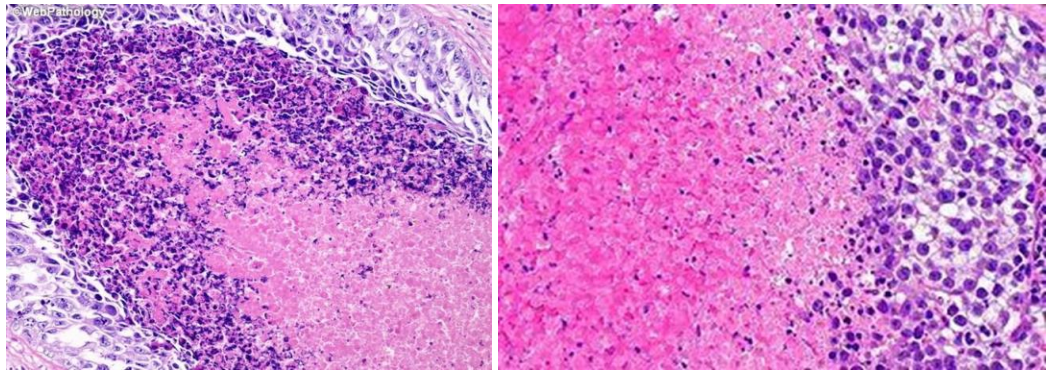
Healthy lung

Differential diagnosis :

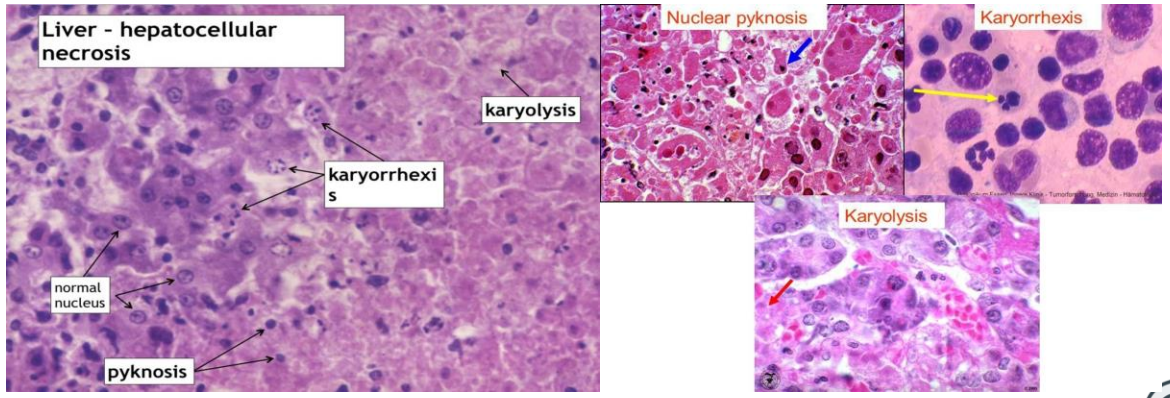
1- Necrosis
2- infection (TB)
3- tumor
4-infraction

2-Microscopic appearance of Necrotic dead cells:

Cytoplasmic changes	Nuclear changes
• Increased binding of eosin to denatured cytoplasmic proteins, loss of basophilic ribonucleic acid (RNA) in the cytoplasm • A glassy, homogeneous appearance, mostly because of the loss of lighter staining glycogen particles and cytoplasm vacuolated and appears “moth-eaten “, due to enzymes	Due to break down of DNA; three patterns: • Pyknosis → shrinkage and increased basophilia. • Karyorrhexis → fragmentation of pyknotic nucleus • Karyolysis → decrease basophilia of chromatin, DNAase: (deoxyribonuclease, DNA digestion). ○ **Note**: In 1-2 days the nucleus in a dead cell may completely disappear.



Intense eosinophilic

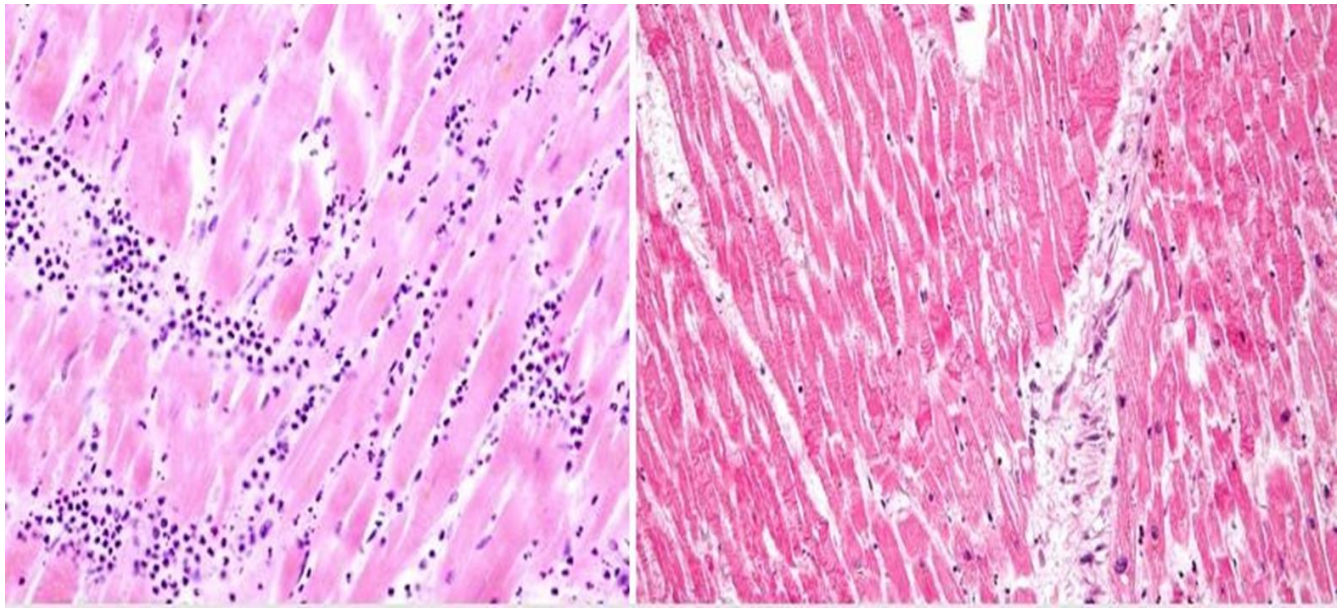


Morphologic Patterns of Necrosis

1. Coagulative necrosis
2. Liquefactive necrosis
3. Caseous necrosis
4. Fat necrosis
5. Fibrinoid necrosis

Coagulative necrosis

- Proteins can denature (coagulate) to leave 'ghost' outlines behind then the dead cells lose their nuclei and may stain more intensely, characteristic of hypoxic cell death in all tissues except in the brain.
- The most common form of necrosis (particularly in myocardium, liver, kidney)



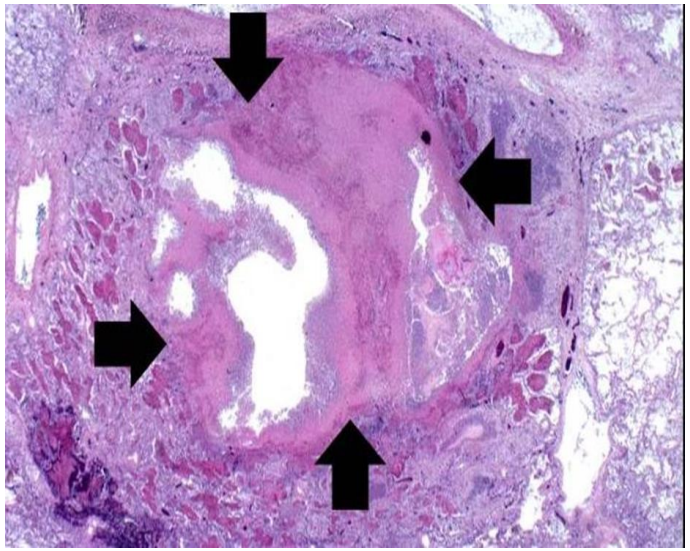
Normal Cardiac Muscle

Anucleated Myocardial cells
GHOST

Liquefactive necrosis

- Infiltration of dead tissue by large numbers of neutrophils leads to digestion of cell proteins. This leads to loss of normal tissue architecture and is known as liquefactive necrosis
- Liquefactive necrosis is common after cell death in lipid-rich tissue such as the brain (cerebral infarction or infections).

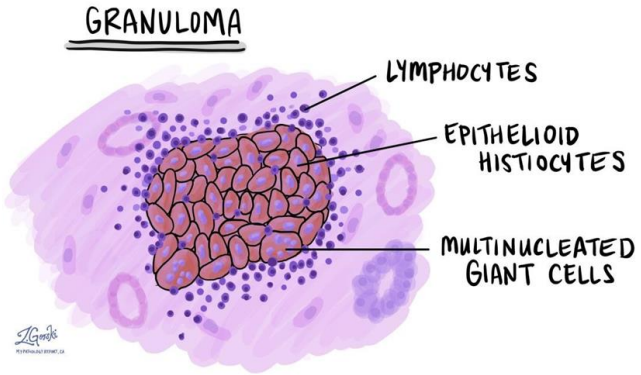
Necrotic Brain (wet , lipid)

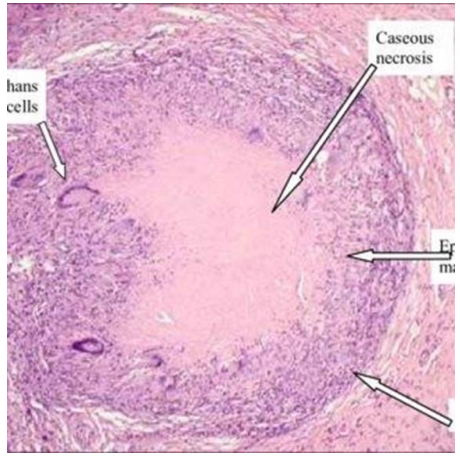


Digestive , Necrotic Area

Caseous necrosis

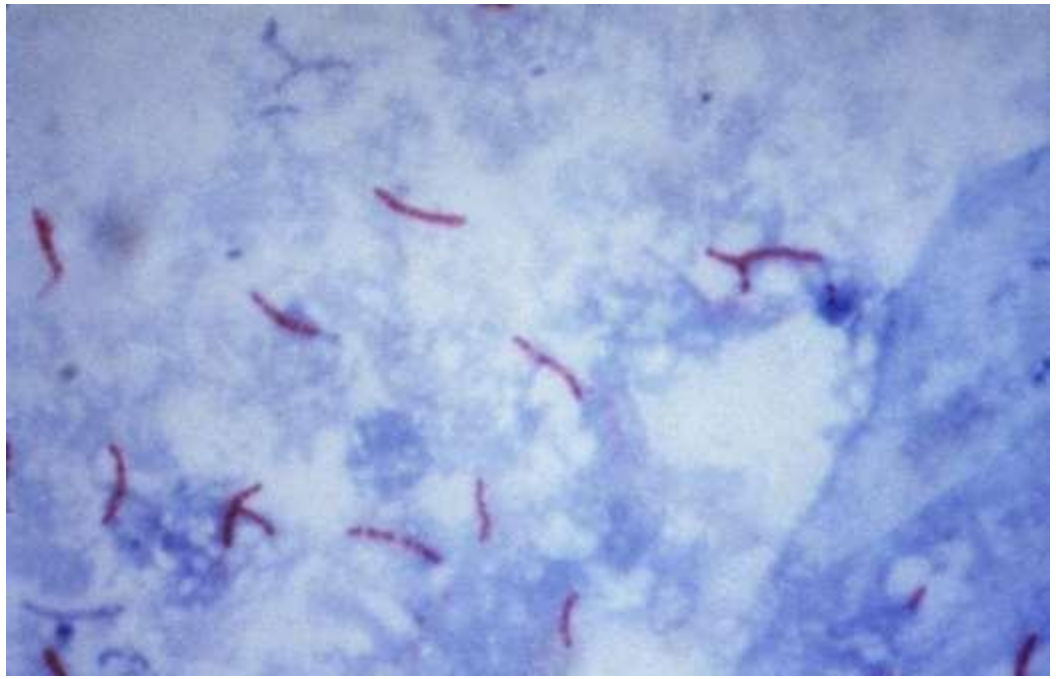
- **Granulomas** are aggregates of epithelioid macrophages and giant cell macrophages, often surrounded by lymphocytes.
- **Granulomas** are found as a response to foreign bodies, in some autoimmune diseases, and in mycobacterial infection (e.g., tuberculosis , Sarcoidosis Rheumatoid arthritis ,Crohn's disease).
- Necrosis can occur in the center of granulomas, typically in mycobacterial infection. This is described as caseous necrosis because the macroscopic appearance was considered to be cheese-like.



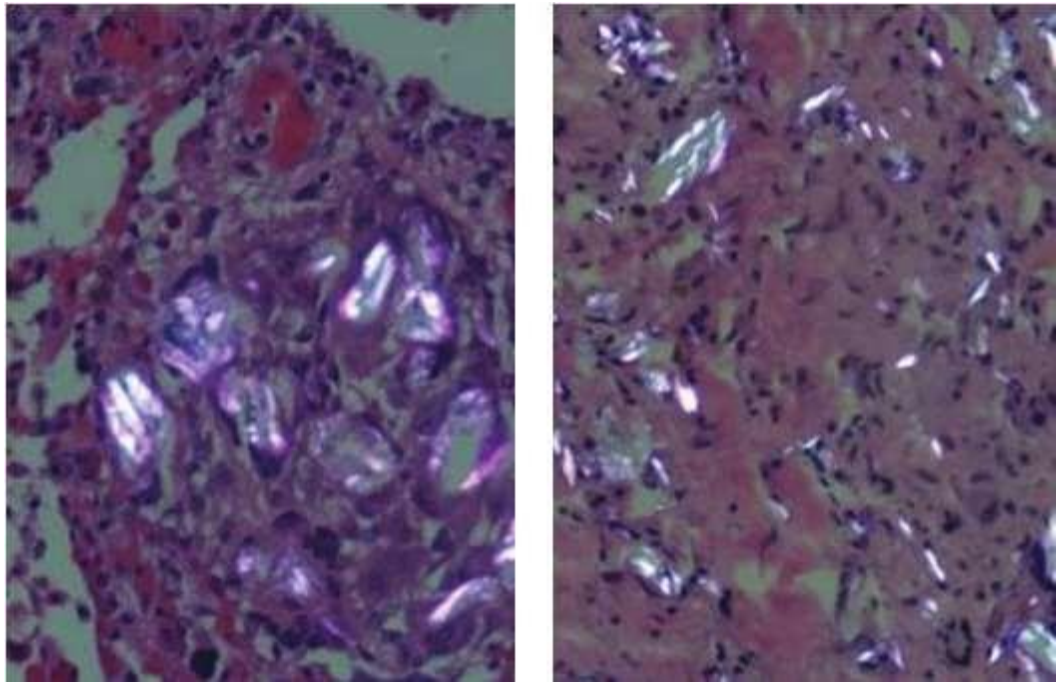


Caseous necrosis

❖ Tuberculosis : mycobacterial infection



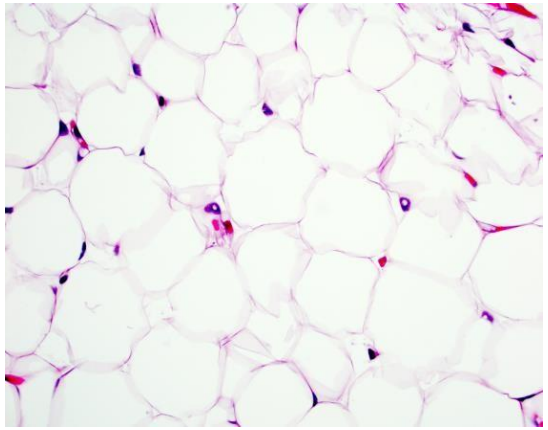
M.tuberculosis
→Ziehl-Neelsen stain



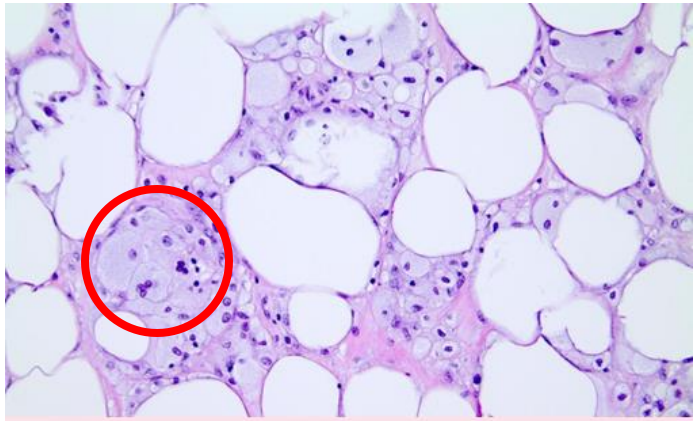
Granuloma caused by foreign bodies

Fat necrosis

- A pattern of necrosis that occurs due to degradation of fatty tissue by lipases (released from dead cells) to form chalky deposits.
- This can be seen in acute pancreatitis (acute inflammation of the pancreas causing necrosis of pancreatic acinar cells and lipase release), or from trauma to fatty tissues (like the breast).



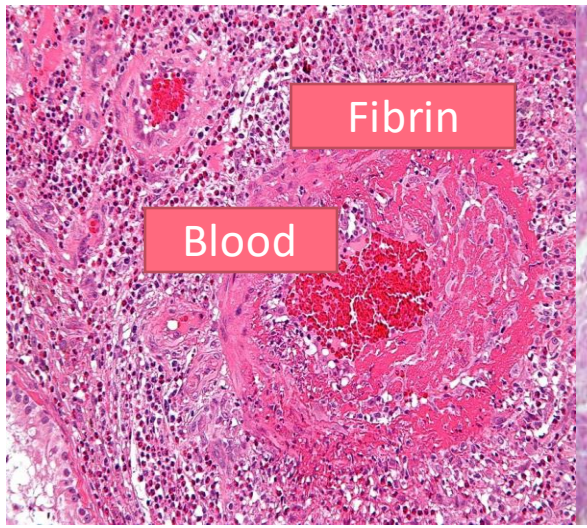
Fatty acids bind and precipitate calcium



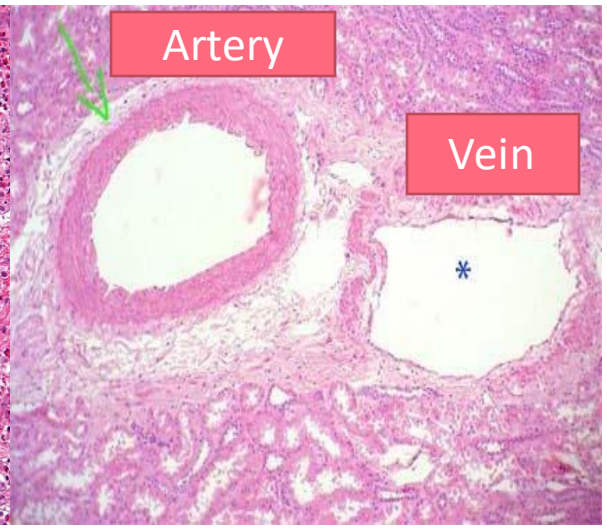
foamy macrophages adjacent to adipose tissue, ions forming insoluble salts.

Fibrinoid necrosis

- Specific pattern of cell death that occurs when antigen- antibody complexes are deposited in the walls of blood vessels along with fibrin.
- In immune reactions: complexes of antigens and antibodies are deposited in the walls of blood vessels as seen in HTN
- Deposited immune complexes and plasma proteins that leak into the wall of damaged vessels produce a bright pink, amorphous appearance→ Fibrin



Fibrinoid necrosis



Normal B.V

Fate of Necrosis

- Most of necrotic tissue is removed by leukocyte (Phagocytosis) combined with extracellular enzyme digestion, If necrotic tissue is not eliminated → it attracts Ca^{2+} salts dystrophic calcification.
- Leakage of intracellular proteins through the damaged cell membrane and ultimately into the circulation provides a means of detecting tissue-specific necrosis using blood or serum samples:
  1. Cardiac muscle →isoform of creatine kinase & troponin. (chest pain , MI)
  2. Hepatic bile duct epithelium →enzyme alkaline phosphatase
  3. Hepatocytes →contain Aspartate transaminases

ARCHIVE Questions

MEDEMIA ACADEMY

ARCHIVE Questions

Q1: Granuloma includes all the following except:

a. Rheumatoid arthritis
b. Crohn's disease
c. Acute staphylococcal infection
d. Sarcoidosis
e. Tuberculosis

Q2: During necrosis, which of the following changes occur to the cytoplasm?

a. Increased eosinophilia as eosin binds with natured cytoplasmic proteins
b. Increased eosinophilia due to loss of ribonucleic acid (DNA) in the cytoplasm
c. Glassy homogeneous cytoplasm, mostly due to loss of lighter staining glucose particles
d. Cytoplasm vacuolated (moth-eaten) due to enzymes

ARCHIVE Questions

Q3: During necrosis, increasing basophilia, shrinkage & fragmentation of nucleus is called:

a. Clumping
b. Karyolysis
c. Karyorrhexis
d. Pyknosis
e. Balloon degradation

Q4:Patient with MI, there will be high serum levels of :

a. Alkaline phosphatase
b. Troponin
c. Transaminases

ARCHIVE Questions

Q5: Cause of liquefactive necrosis :

a. Fungal infections
b. Tuberculosis
c. Sever hypertension
d. Immune reaction

Q6: All of the following are correct except :

a. Focal bacterial…….Liquefactive necrosis
b. granuloma ……Caseous necrosis
c. immune reaction…….fibrinoid necrosis
d. multiple tissue layers …….coagulative necrosis

ARCHIVE Questions

Q7 : Old women did a test , the result was that she has TB, which type of necrosis does she have :

a. coagulative
b. liquefactive
c. Fat necrosis
d. Caseous Necrosis
e. fibrinoid necrosis

Q8: A disease that involves collection of granulomas: Sarcoidosis

ARCHIVE Questions

Q9: which the following is not correct about fibrinoid necrosis:

a. modren of pathology
b. deposition of fibrin-like material within blood vessel walls.
c. It often occurs in immune-related diseases .
d. Fibrinoid necrosis can lead to disruption of blood vessel integrity, potentially causing hemorrhage or tissue ischemia.

Q10: Most abundant type of inflammatory cells seen in liquefactive necrosis:

a. Neutrophils
b. Lymphocytes
c. Eosinophils
d. Monocytes

ARCHIVE Questions

Q11: Wrong about Nuclear appearance of Necrotic cell :

a. pyknosis
b. karyorrhexis
c. karyolysis
d. Mitosis

Q12: Considering detecting tissue-specific proteins in blood or serum samples, ONE of the following pairs is wrongly matched?

a. Cardiac muscle: Creatine kinase isoform.
b. Cardiac muscle: Troponin.
c. Hepatic bile duct epithelium: Alkaline phosphatase.
d. Hepatic bile duct epithelium: Creatine kinase isoform.
e. Hepatocytes: Transaminases.

ARCHIVE Questions

Q13: Which of the following granulomatous conditions is associated with numerous neutrophils?

a. Tuberculosis.
b. Cat scratch disease.
c. Crohns disease.
d. Syphilis.
e. Sarcoidosis.

Q14: Most common form of necrosis?

a. Coagulative
b. Liquefactive
c. Fat

ARCHIVE Questions

Q15: Which of the following cases would most likely present with caseous necrosis?

a. Pulmonary Tuberculosis.
b. Severe hypertension.
c. Acute pancreatitis.
d. Hypoxic and death of cells within the central nervous system.
e. Myocardial infarction

ARCHIVE Questions

Q16: A 72-years-old man presented to the emergency with loss of consciousness, after gaining his consciousness 30 minutes later, he could not speak or move his left arm, six week later, a brain CT scan showed a large cystic area in the right parietal lobe, WHICH of the following pathologic processes has most likely occurred in her brain?

a. Apoptosis
b. Coagulative necrosis
c. Fat necrosis
d. Fibrinoid necrosis
e. Liquefactive necrosis

ARCHIVE Questions

Q17: A 56 year old male experienced sudden onset of severe sharp chest pain and shortness of breath, he has rushed to the hospital where on physical examination he has tachycardia and the Electrocardiographic changes suggest the possibility of myocardial infarction, Which of the following laboratory tests on the patients serum is most useful in this situation?

a. Adrenaline
b. Troponin
c. Bilirubin
d. Alkaline phosphate
e. Transaminase

ARCHIVE Questions

Q18: Which Of the following cases would most likely present with fat necrosis?

a. Myocardial Infarction
b. Severe hypertension
c. Acute pancreatitis
d. Hypoxic and death of cells within the central nervous system

Q19: A 53-year-old female has experienced severe chest pain for the past 6 hours. Laboratory studies show elevated serum troponin. The electrocardiogram changes suggest an irreversible injury to myocardial fibers. Which of the following pathologic processes has most likely occurred in her heart?

a. Apoptosis.
b. Coagulative necrosis.
c. Fat necrosis.
d. Fibrinoid necrosis.
e. Liquefactive necrosis.

ARCHIVE Questions

Q20: One of the following is correct about necrosis?

a. If a necrotic tissue is not phagocytized it attracts calcium salts.
b. Necrosis never elicits a local host reaction or inflammation.
c. Necrosis is regulated by specific signals or biochemical mechanisms.
d. A form of cell death in which the cell membrane is kept intact
e. Necrosis is sometimes called suicidal cell death.

Q21: All the following is correct about necrosis EXCEPT?

a. if a necrotic tissue is not phagocytized it attract calcium salts
b. necrotic cells usually disappear due to enzymatic digestion and phagocytosis
c. necrosis is regulated by specific signals or biochemical mechanism
d. severe disturbances like hypoxia and ischemia cause necrosis
e. necrosis is something called accidental cell death