Abnormal Tissue Deposits

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Outlines

- **By the end of this session; you will be able to:**
  - **Define amyloidosis and identify main pathological effects and complications**
  - **Have a good idea about hyaline change of cells and tissues**
  - **Know abnormal pigmentation**
  - **Define abnormal calcification, know types and pathological features**

Introduction

- **Definition**:
  - Accumulation of abnormal amounts of various substances

- **General features**
  - The deposited material may be:
    - Extracellular: e.g. amyloidosis
    - Intracellular: e.g. abnormal pigmentation
    - Extra- and intracellular: e.g. calcium deposition
  - The deposited material may be:
    - Harmless to the cells: e.g. cloudy swelling
    - Have a toxic or damaging effects: e.g. amyloidosis

Introduction

- **Examples:**
  - Excess normal cellular constituents:
    - Water: in Cloudy swelling & Hydropic degeneration
    - Lipids: in Fatty change
    - Mucin: in Mucoid change & Myxoid degeneration
  - Deposition of abnormal substances:
    - Exogenous e.g. products of infectious agents
    - Endogenous e.g. products of abnormal metabolism
  - Deposition of pigmented substance

AMYLOIDOSIS

Amyloidosis

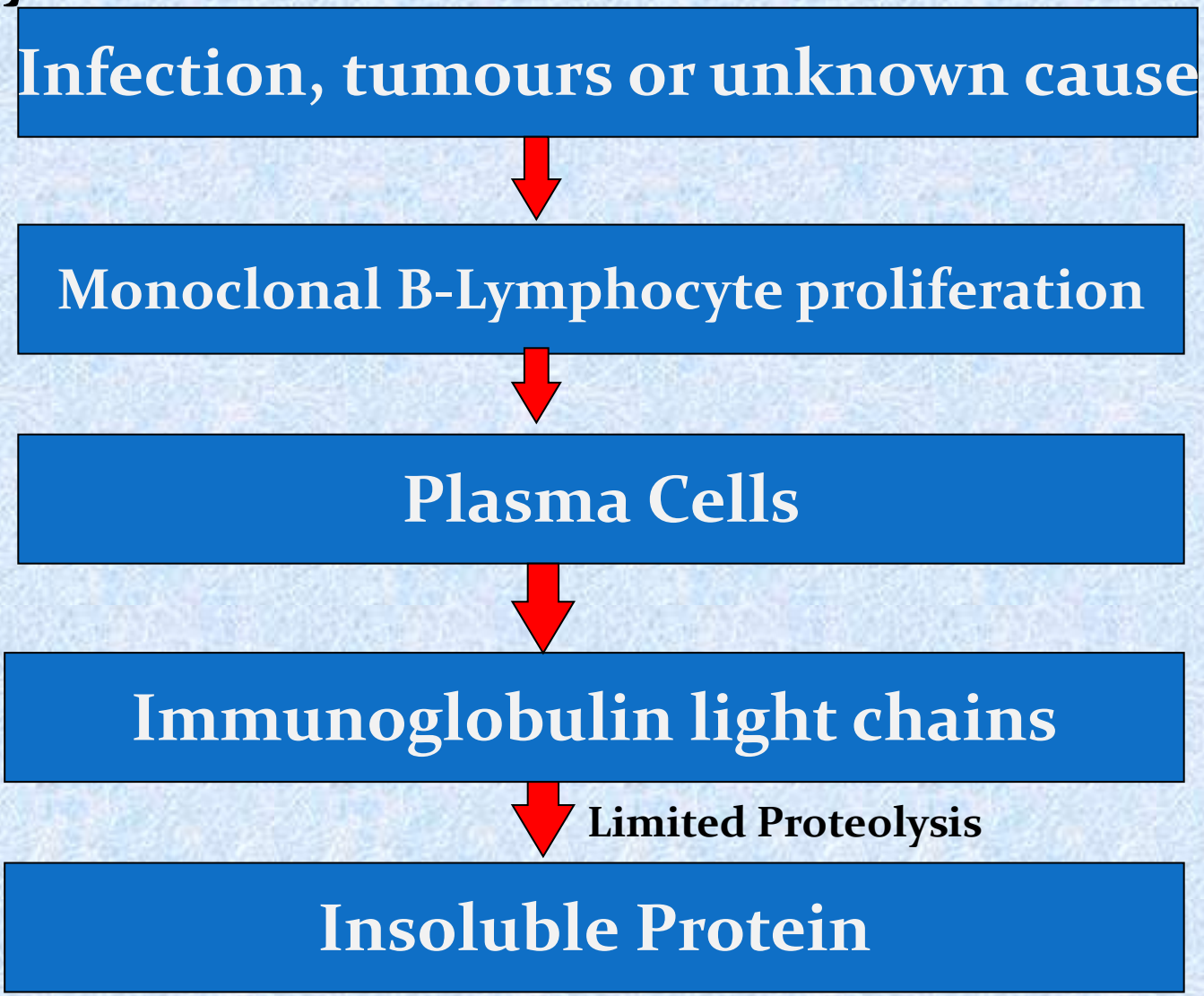
- **Definition**:
  - Extracellular deposition of amyloid material

- **Nature of amyloid material**

  A waxy hyaline proteinaceous material formed of:
  - 90% formed of fibril proteins:
    - Amyloid light chain protein (AL protein)
    - Amyloid associated protein (AA protein)
    - β2-microglobulin
  - 10% formed of glycoprotein (P protein):

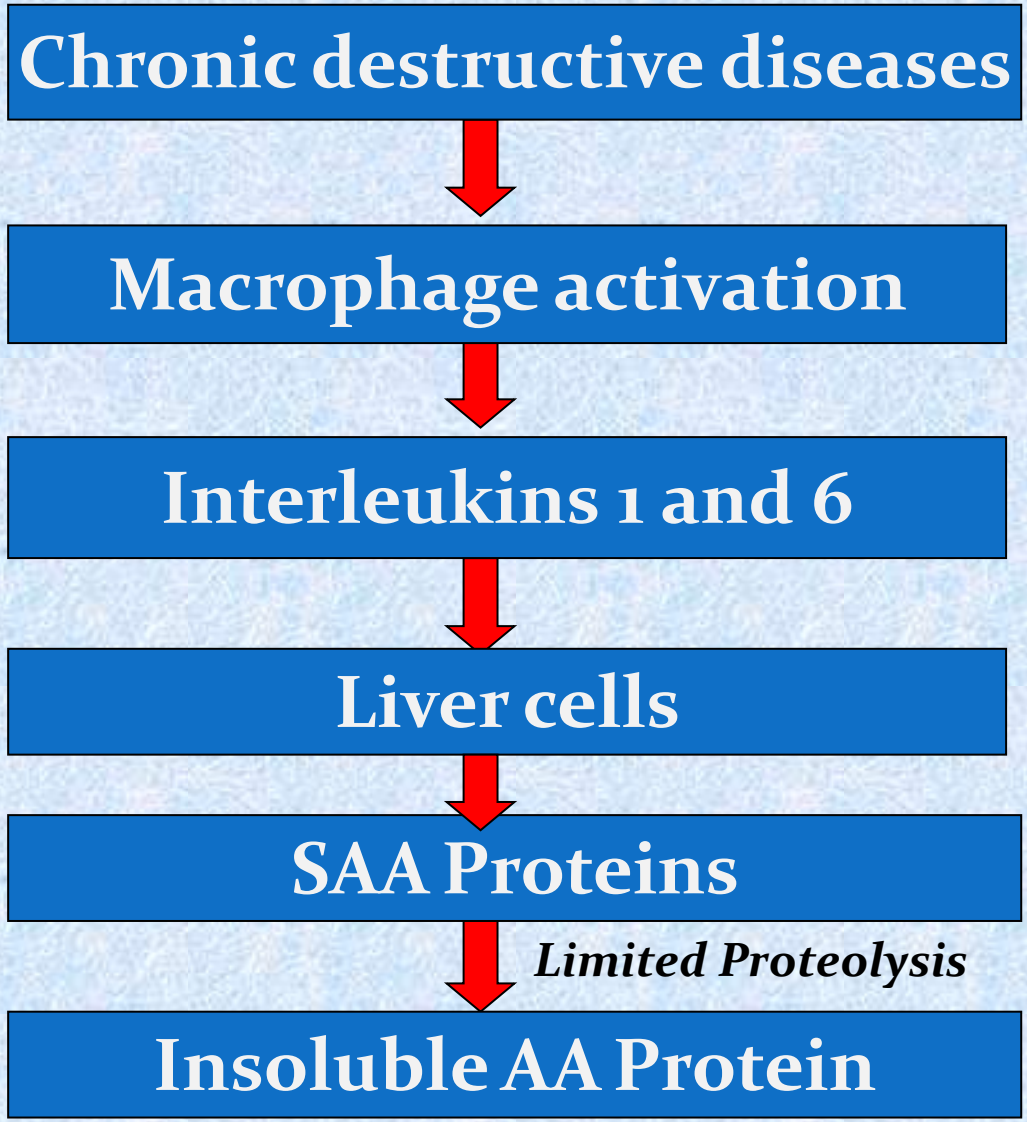
Amyloidosis

- **AL amyloid material:**



Amyloidosis

- **AA amyloid material:**



Amyloidosis

- **Sites of amyloid deposition**:

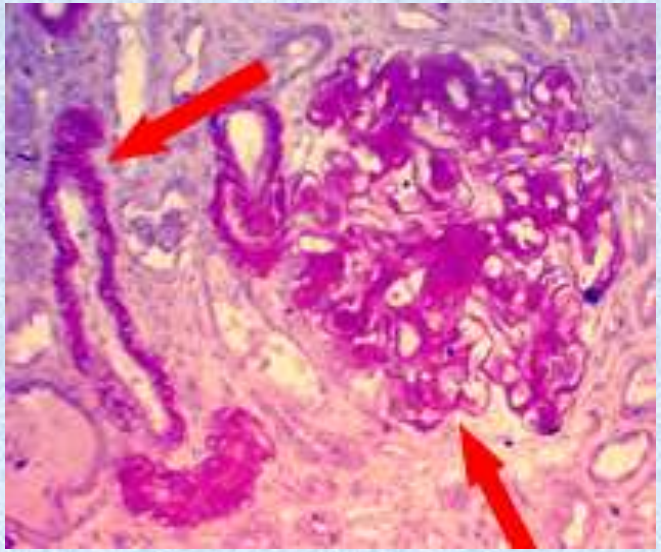
  - Amyloid protein tends to deposit at extracellular connective tissue mainly:
    1. *Walls of small blood vessels*
    2. *Basement membranes*
    3. *Reticulin fibers*

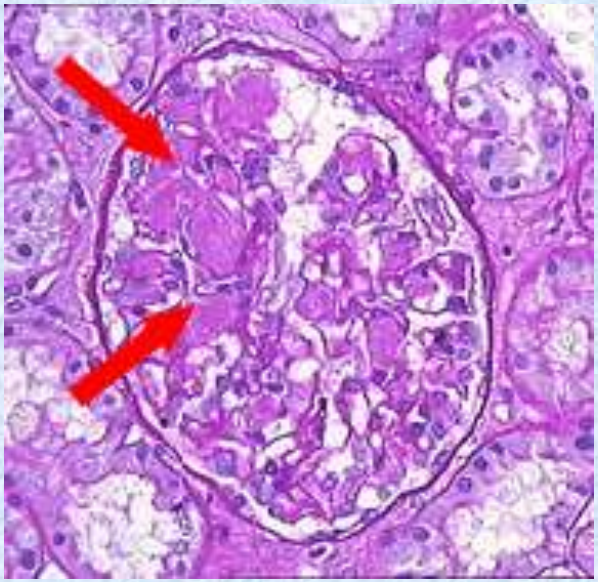
Amyloidosis

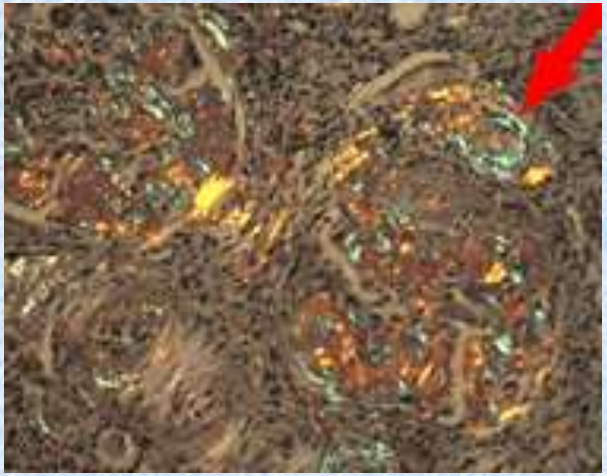
- **Staining of amyloid material**:
  - **Gross staining:**
    - Lugol's iodine: **dark brown**
    - Iodine + sulphuric acid: **blue**
  - **Microscopic staining:**
    - Routine H&E stain: **homogenous pale pink**
    - Congo red stain:
      - light microscope: **orange red**
      - polarizing microscope: **green**
    - Metachromatic stains: **red**

Amyloidosis

- **Staining of amyloid material**:
  - **Microscopic staining:**

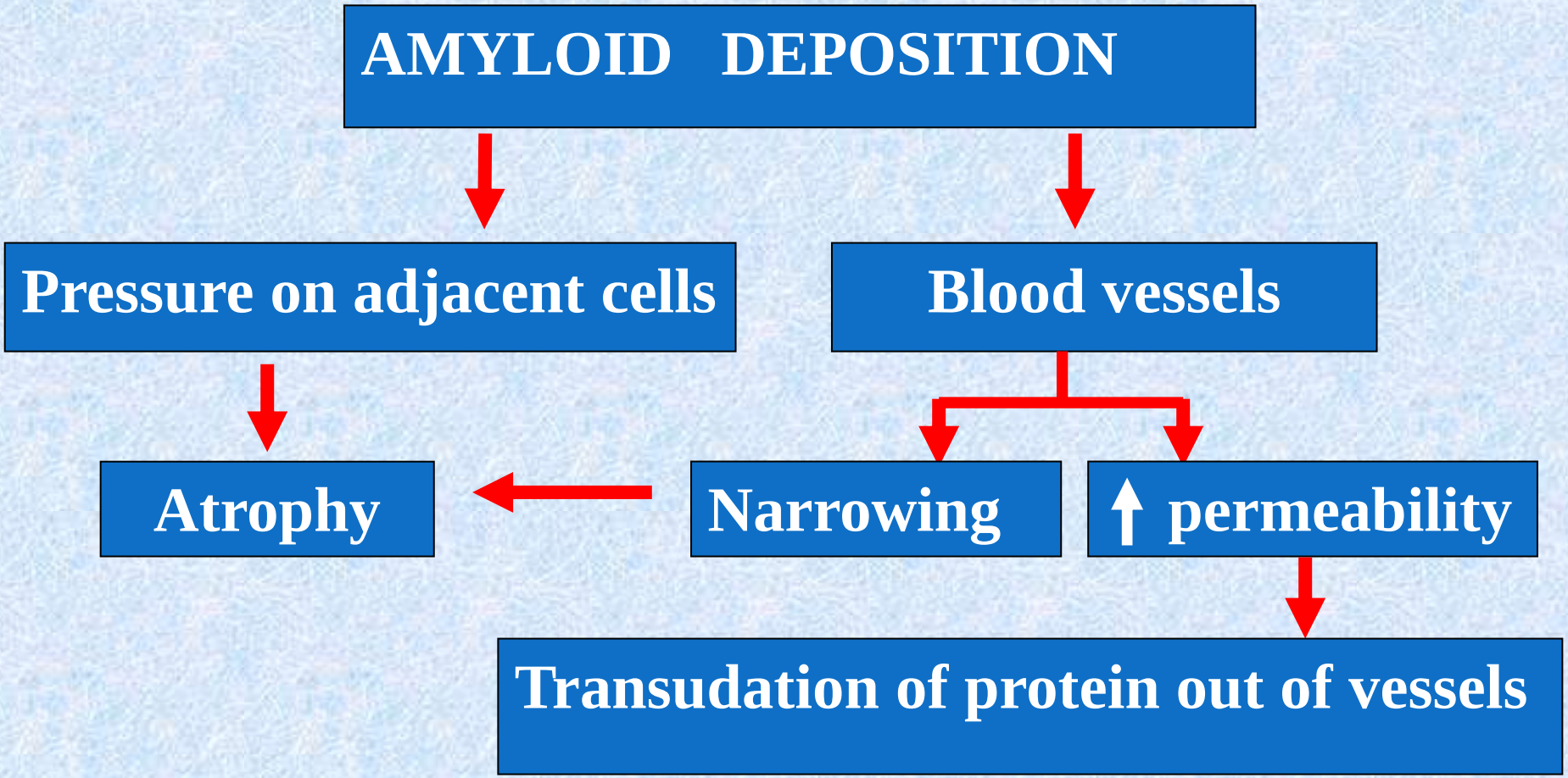






Amyloidosis

- **Effect of amyloid material:**



Amyloidosis

- **Clinical significance of amyloidosis**:
  - Amyloid deposition is a permanent change and persists for life.
  - It may cause serious diseases as renal failure (in kidney), or diabetes mellitus (in pancreas).
  - It has no curative treatment

Amyloidosis

- **Types of amyloidosis:**

A. Localized amyloidosis

- Amyloid deposit is limited to single organ or tissue

B. Systemic (Generalized) amyloidosis:

- Affection of multiple organs and tissues

Amyloidosis

❑ Types of amyloidosis:

A. Localized amyloidosis

- Amyloid deposit is limited to single organ or tissue
- Examples:
  - ➢ Amyloidosis of the tongue, larynx, lung, skin and UB
  - ➢ Amyloid deposit in tumors of endocrine glands as islet tumor of pancreas and medullary carcinoma of thyroid
  - ➢ Amyloid deposit in cerebral grey matter in Alzheimer

Amyloidosis

- **Types of amyloidosis:**

B. Systemic (Generalized) amyloidosis:

- Affection of multiple organs and tissues
- Subtypes:

1. Primary Amyloidosis
2. Secondary Amyloidosis
3. Haemodialysis-associated Amyloidosis
4. Hereditary Amyloidosis

Amyloidosis

- **Types of amyloidosis:**

B. Systemic (Generalized) amyloidosis:

1. Primary Amyloidosis

- Systemic in distribution.
- Amyloid is of AL protein.
- Most patients have some form of plasma cell diseases (e.g. plasma cell tumors).
- Organs most commonly affected are heart, kidney, GIT, tongue, skeletal muscle

Amyloidosis

- **Types of amyloidosis:**

B. Systemic (Generalized) amyloidosis:

2. Secondary (reactive) amyloidosis

- Systemic in distribution.
- Amyloid is of AA protein.
- It complicates chronic conditions as:
  - Chronic suppuration: osteomyelitis, lung abscess, pyelonephritis……
  - Granulomatous diseases: TB, leprosy……
  - CT diseases: as RA, SLE……
  - Some malignant tumors as gastric carcinoma and Hodgkin's lymphoma)
- Organs most commonly affected are kidney, liver, spleen

Amyloidosis

- **Types of amyloidosis:**

B. Systemic (Generalized) amyloidosis:

3. Haemodialysis associated amyloidosis

- Systemic in distribution.
- Affects about 70% of patients on chronic renal dialysis.
- Amyloid protein is of β2-microglobulin.
- Common affected sites are joints and periarticular tissues.

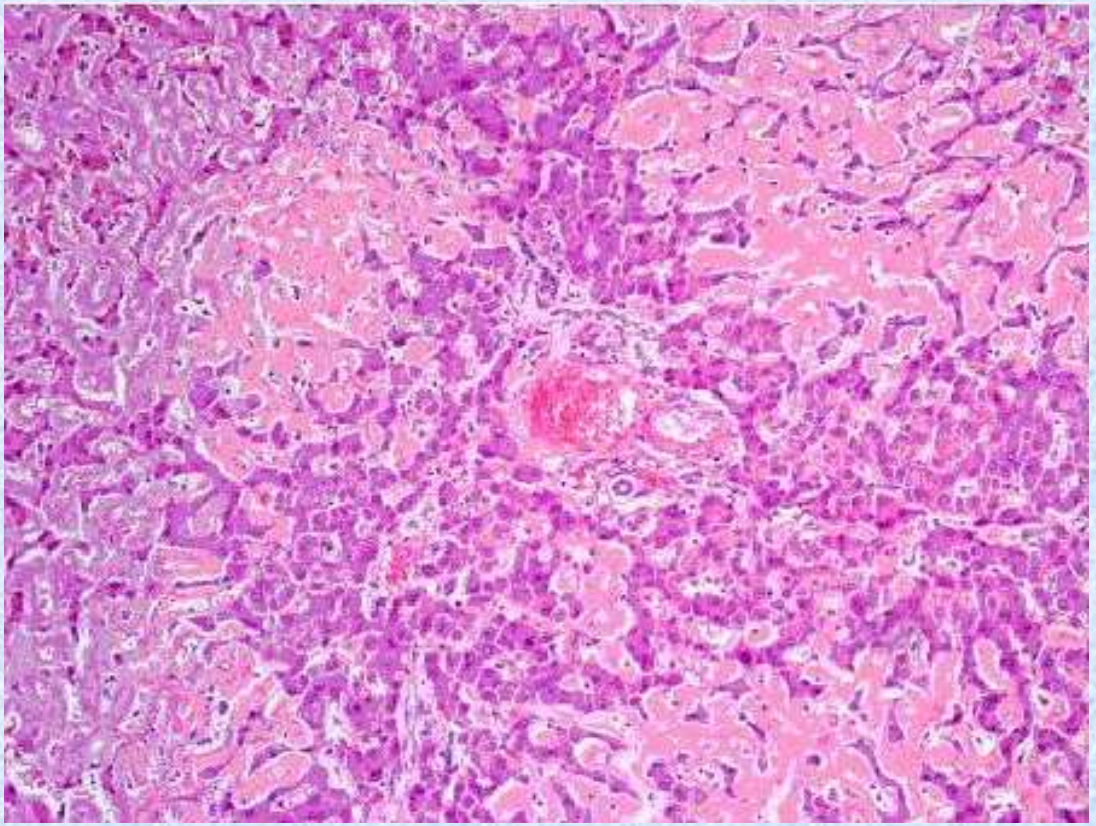
Amyloidosis

❑Amyloidosis of the liver:

- **Gross picture:**
  - ➢The liver is enlarged, firm, with sharp borders.
  - ➢Cut surface shows light brown streaks
- **Microscopic picture**: amyloid is deposited in:
  - ➢ Space of Disse between liver cells & endothelium of sinusoids, with replacement of liver cells
  - ➢ Walls of hepatic arterioles & venules, leading to thickening of the walls & narrowing of the lumens

Amyloidosis

- **Amyloidosis of the liver:**
  - **<u>Microscopic picture</u>**:



Comment??

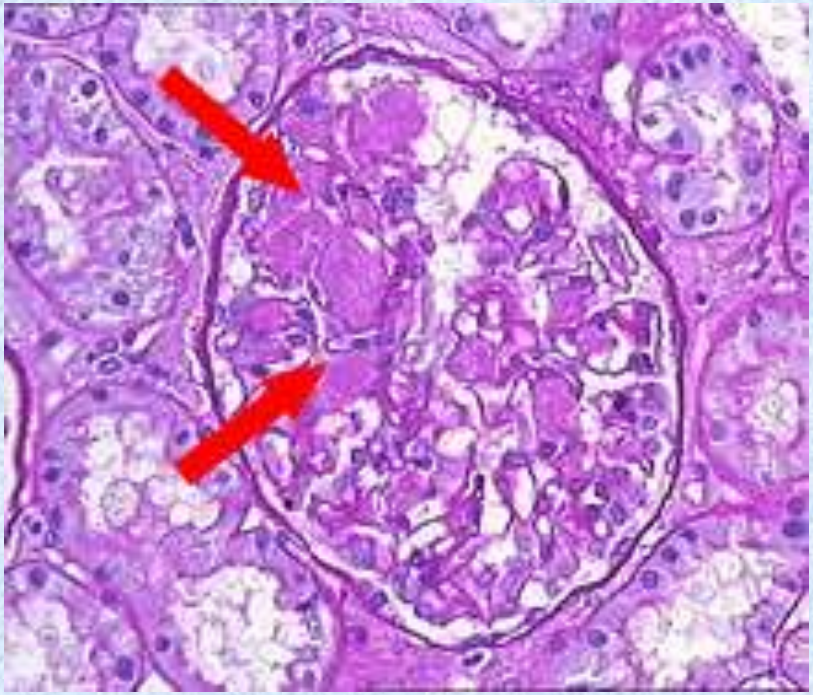
Amyloidosis

❑Amyloidosis of the kidney:

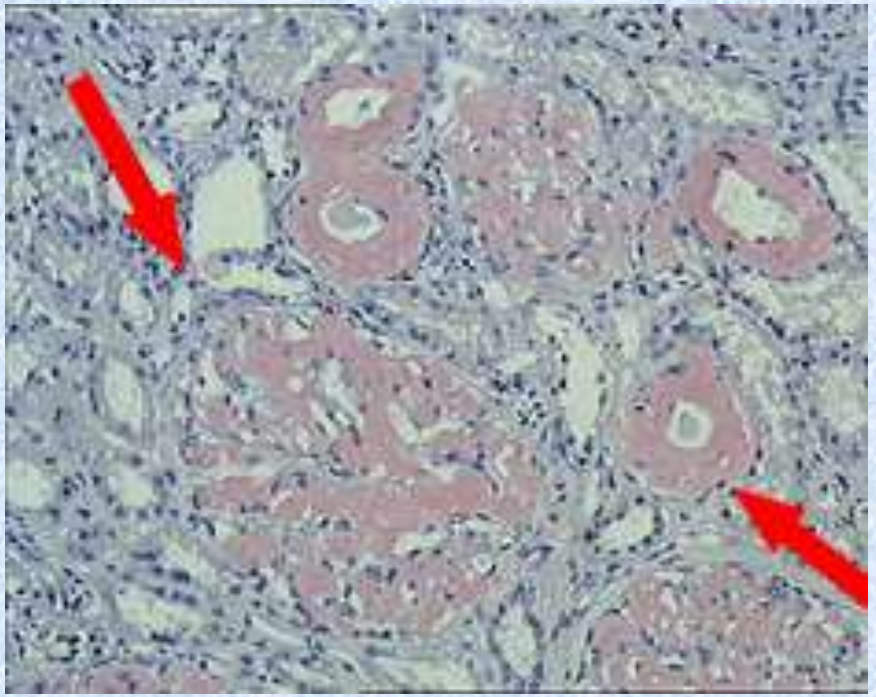
- **<u>Gross picture:</u>**
  - ➢ may be normal in size or enlarged
  - ➢ in longstanding cases: small contracted kidney
- **<u>Microscopic picture</u>**: homogenous pink amyloid deposit in:
  - ➢ Basement membranes of glomerular capillaries and collecting tubules
  - ➢ Walls of renal arterioles & venules, leading to thickening of the walls & narrowing of the lumens.

Amyloidosis

- **Amyloidosis of the liver:**
  - **Microscopic picture**:



H&E staining



Congo red stain

Amyloidosis

❑Amyloidosis of the spleen:

- **<u>Focal type (Sago Spleen):</u>**
  - ➢ Amyloid is deposited in the wall of central arteriole of lymph follicles → gradually replaced by amyloid
- **<u>Diffuse type:</u>**
  - ➢ Amyloid is deposited in
    - C.T. framework of red pulp
    - walls of splenic sinuses
  - ➢ the lymphoid follicles are compressed & atrophic

Abnormal pigmentation

Abnormal pigmentation

- **Nature:**
  - Exogenous Pigmentations:
    - Pigments introduced into the body from outside by
      - Inhalation: e.g. Anthracosis
      - Ingestion: e.g. Plumbism
      - Inoculation to skin: Tattooing
  - Endogenous pigmentations:
      - Melanin pigment
      - Lipofuscin pigment
      - Hemoglobin-Derived pigments

Abnormal pigmentation

- **Melanin pigmentation:**
  - Increased melanin pigments occurs in:
    - Prolonged exposure to sun
    - Chloasma (Melasma): Facial hyperpigmentation occuring with pregnancy or the use of OCCs
    - Addison's Disease: Chronic adrenal cortical insufficiency → increased ACTH → increased production of melanin.
    - Nevus or Melanomas: Tumors of melanocytes

Abnormal pigmentation

- **Melanin pigmentaion:**

Chloasma (Melasma)

Addison's disease:

Abnormal pigmentation

- **Melanin pigmentation:**
  - Decrease melanin pigments occurs in:
    - **Albinism**:
      - Hereditary condition characterized by deficiency of tyrosinase enzyme → absence of melanin pigment → white hairs & pink skin, iris, & choroid
    - **Leucoderma**:
      - Patchy skin hypopigmentation.
      - It may idiopathic or secondary to leprosy or syphilis.

Abnormal pigmentation

- **Hemoglobin-derived pigments:**
  - The pigments are derived from hemoglobin breakdown:
    - Bilirubin: iron-free pigment excess of which leads to jaundice
    - Haemosiderin: leads to **hemosidrosis**
    - Hematin: leads to **hemochromatosis**

Abnormal pigmentation

- **Hemoglobin-derived pigments:**
  - **hemosidrosis**
    - Pathological excess deposition of iron containing insoluble haemosiderin material in tissues.
    - Two types:
      - Localized
      - Generalized

Abnormal pigmentation

- **Hemoglobin-derived pigments:**
  - **hemosidrosis**
    - **<u>Localized</u>**
      - Occurs in and around areas of hemorrhage
      - Examples include:
        - lung in cases of chronic venous congestion
        - around infarcts and varicose veins
        - around areas of bruising
      - Fate: hemosiderin gets phagocytosed by macrophages

Abnormal pigmentation

❑**Hemoglobin-derived pigments:**

- ❖ **hemosidrosis**
  - ○ **<u>Localized</u>**

- ● Occurs hemorrhage
- ● Exampl
  - lung us congestion
  - arou veins
  - arou
- ● Fate: he ytosed by macrophages

Abnormal pigmentation

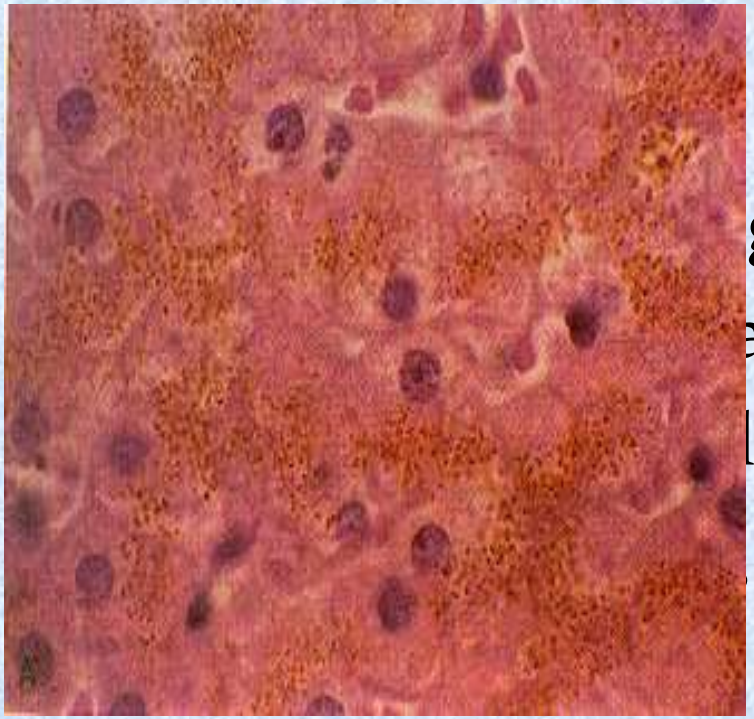
- **Hemoglobin-derived pigments:**
  - **hemosidrosis**
    - **<u>generalized</u>**
      - ***Cause***: Iron overload due to :
        - excess iron therapy
        - excess destruction of RBCs (Hemolytic anemia)
        - repeated blood transfusions
        - impaired utilization of iron (B.M. hypofunction)

Abnormal pigmentation

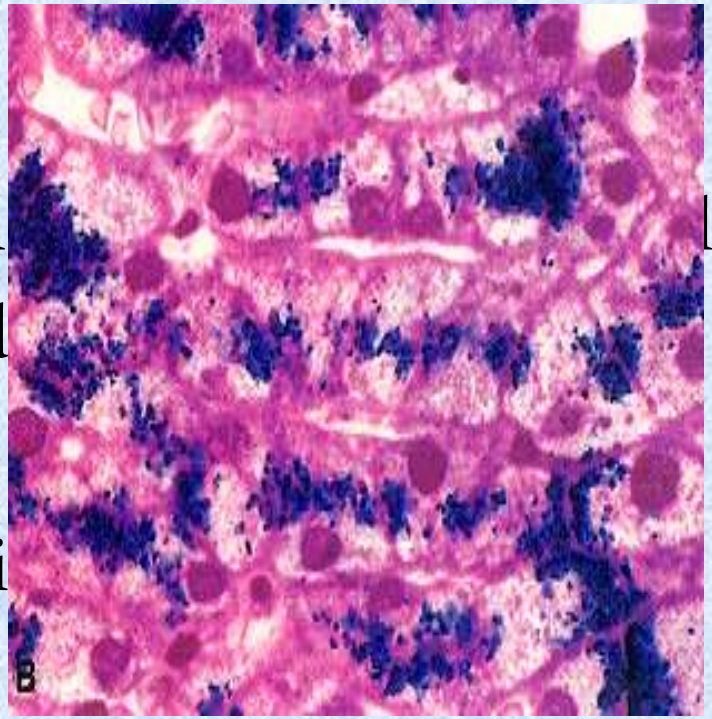
- **Hemoglobin-derived pigments:**
  - **hemosidrosis**
    - **<u>generalized</u>**
      - ***Effects***:
        - Haemosiderin pigment is deposited mainly in phagocytic cells and to lesser degree in parenchymal cells especially hepatocytes and renal tubular cells
        - Tissue damage is mild.

Abnormal pigmentation

- **Hemoglobin-derived pigments:**
  - **hemosidrosis**
    - **generalized**



HE Stain



Prussian blue reaction.

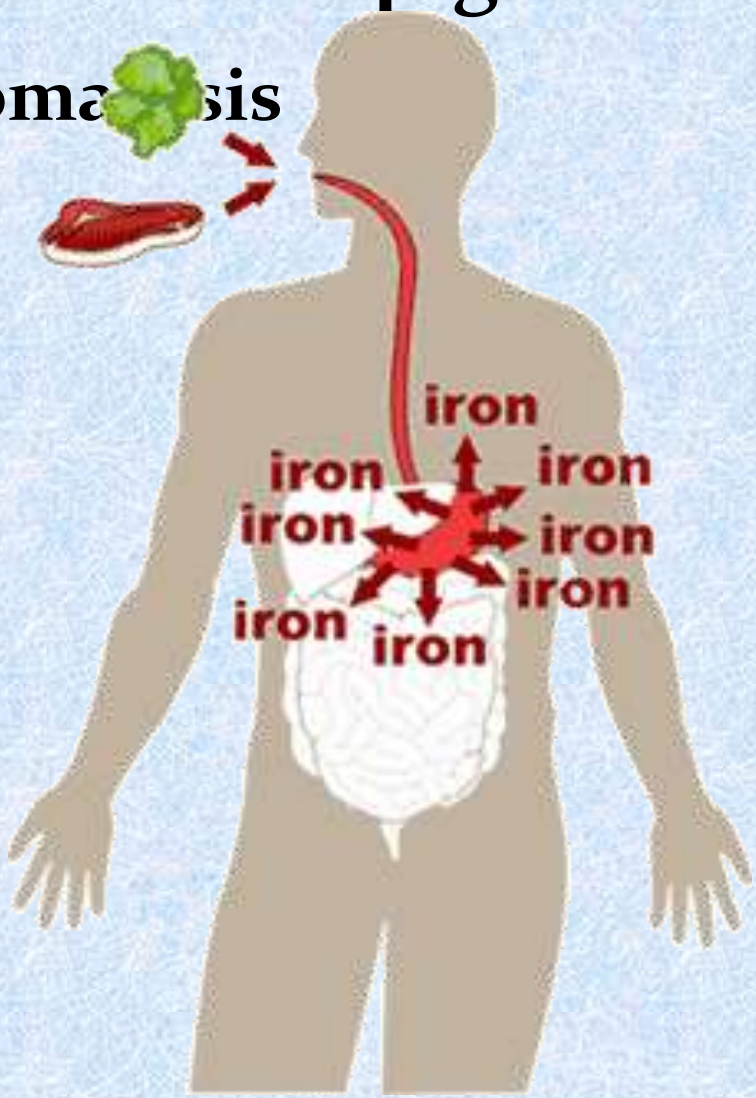
Hemosiderin granules in liver cells

Abnormal pigmentation

- **Hemoglobin-derived pigments:**
  - **hemochromatosis**
    - ***Cause***:
      - Deposition of the hematin, a changed hemoglobin by effect of acids or alkalies.
      - Caused by excess iron absorption due to inborn error of metabolism leading to iron overload

Abnormal pigmentation

- **Hemoglobin-derived pigments:**
  - **hemochromatosis**
    - ***Cause***:



Abnormal pigmentation

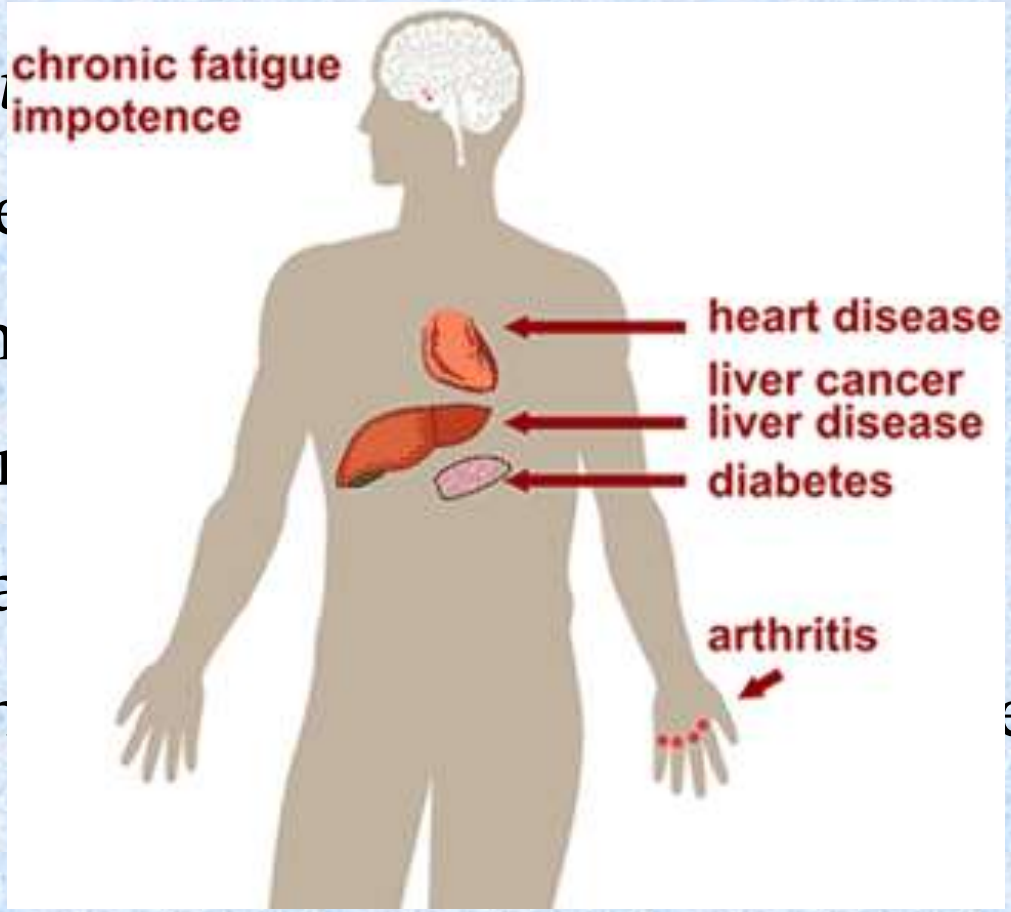
- **Hemoglobin-derived pigments:**
  - **hemochromatosis**
    - ***Effects:***
      - haemosiderin pigment is deposited in parenchymal cells and in phagocytic cells.
      - The affected cells undergo necrosis followed by fibrosis.

Abnormal pigmentation

- **Hemoglobin-derived pigments:**
  - **hemochromatosis**
    - ***Main organs involved***:
      - Liver: → pigmentary cirrhosis
      - Pancreas: → Diabetes Mellitus
      - Skin: → bronzed color
      - Heart: → enlarged & pigmented
      - Other sites: joints, testis, endocrine glands, …

Abnormal pigmentation

- **Hemoglobin-derived pigments:**
  - **hemochromatosis**
    - ***Ma***
      - Live
      - Pan
      - Ski
      - Hea
      - Oth



e glands, ...

HYALINOSIS

Hyalinosis

- **Definition:**

An alteration of cells or tissue, giving a homogenous pink structurless appearance.

- **Nature:**
  - The exact nature is unknown
  - The appearance is probably due to coagulation and dehydration of proteins

Hyalinosis

- **Significance:**
  - Hyaline change occurs under a wide variety of pathological conditions
  - It does not have a specific clinical significance.

- **Types:**
  - Intracellular hyaline deposits
  - Extracellular hyaline deposits

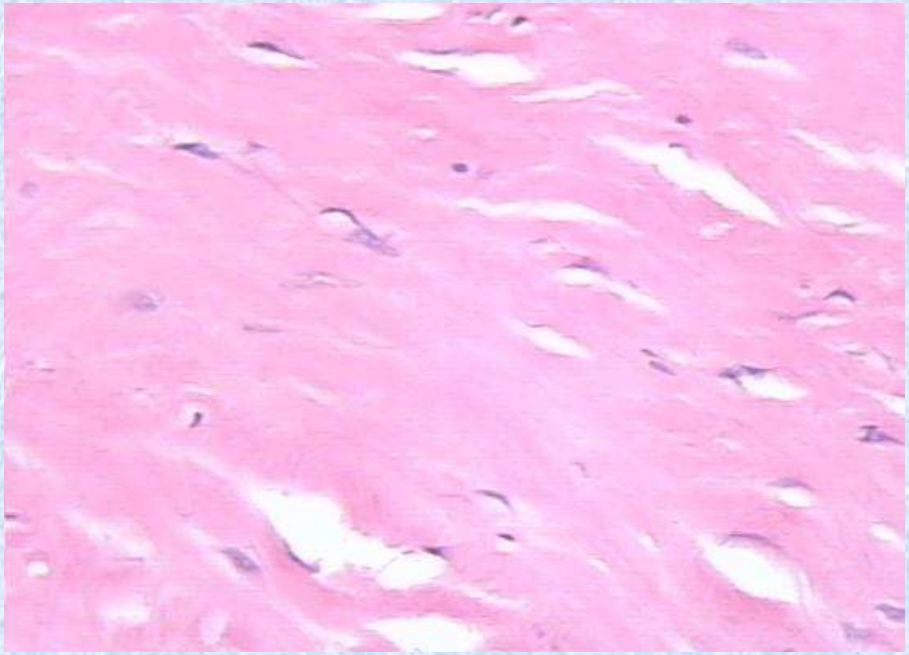
Hyalinosis

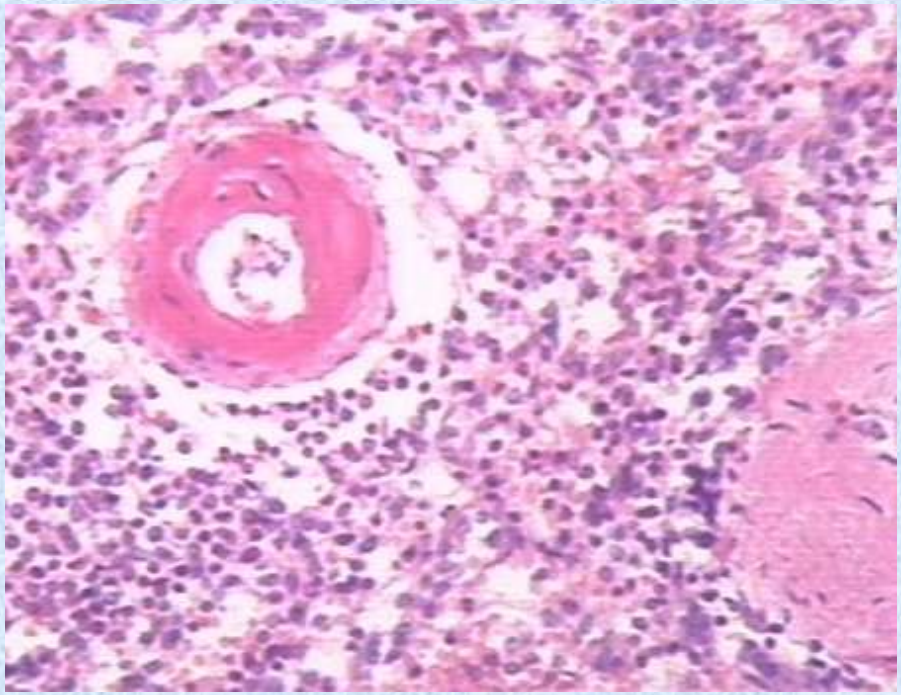
- **Cellular hyalinosis:**
  - Plasma cells: Russell bodies
  - Hepatocytes: Mallory body
  - Prostatic acini: Corpora Amylacea
  - Skeletal muscles: Zenker's degeneration
    - In skeletal muscles during fatal toxic conditions
    - Groslsy: pale friable muscle.
    - MP: thin homogenosu pink muscle fibers with lost striation
  - Old thrombus

Hyalinosis

- **Extracellular (connective tissue) hyalinosis:**
  - In walls of blood vessels:
    - arterial wall in atherosclerotic patients
    - arteriolar wall in hypertensive patients
    - renal afferent and efferent arterioles in GN
    - Vessels of different body organs in old age
  - In old scars
  - In some tumors, esp. leiomyomas

Hyalinosis





CALCIFICATION

Pathological calcification

❑Definition

Abnormal deposition of calcium salts in tissues other than bone and teeth.

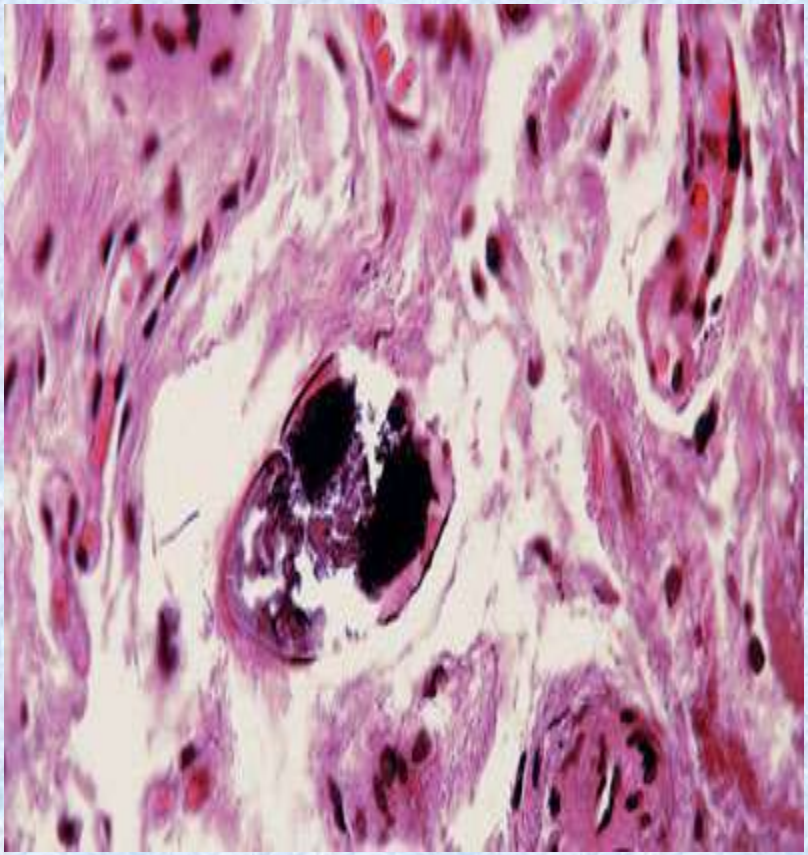
❑Types:

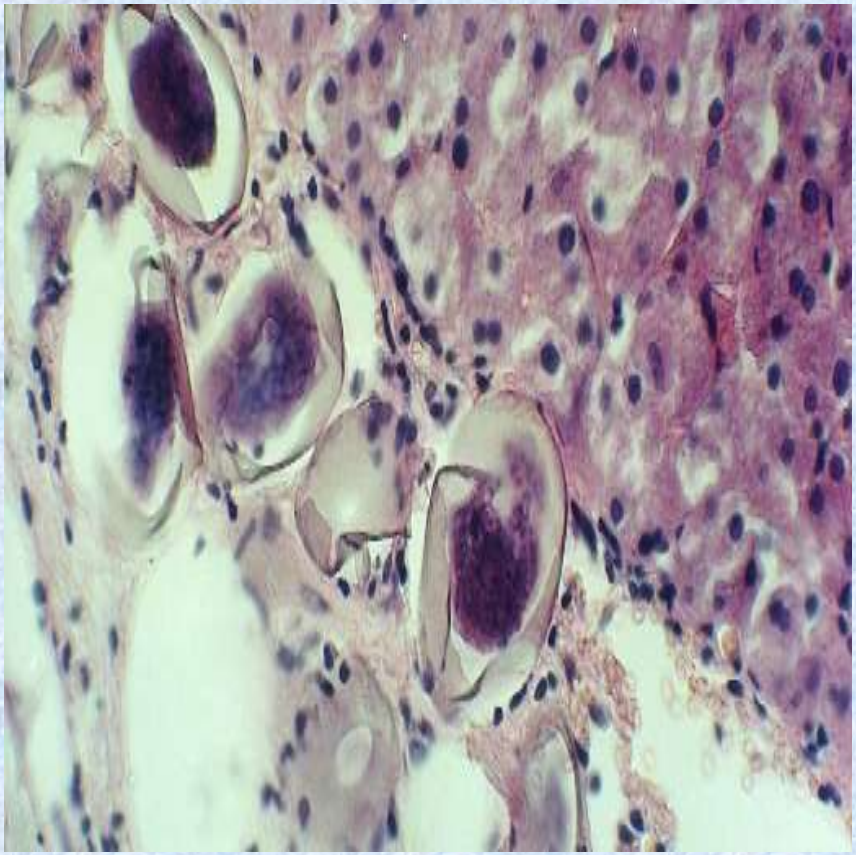
A. Dystrophic calcification: in injured/necrotic tissues
B. Metastatic calcification: in living tissues
C. Calcium stones: in hollow organs

Pathological calcification

Dystrophic calcification	**Metastatic calcification**
Normal blood level of calcium	High blood level of calcium due to*……???*
Necrotic & Injured tissues	Living tissues (+injured tissue)
Injured tissues: -Atherosclerosis -Degenerated valves - Degenerated tumors - Old scars *Necrotic tissues:* -TB lesions -Old infarcts & old thrombi -Dead parasites (bilharzial ova) -Fat necrosis	- Gastric mucosa - Renal tubules - Walls of lung alveoli - Media of blood vessels - Any focus of dead or injured tissue

Pathological calcification





Thank you

Good luck

Dr Ahmed Roshdi