

Cellular Adaptations & Subcellular Alterations Part-II

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General Pathology

Lecture Learning Outcomes:

By the end of this lesson students will be able to:

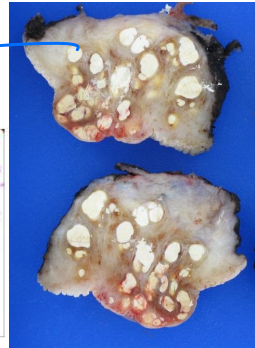
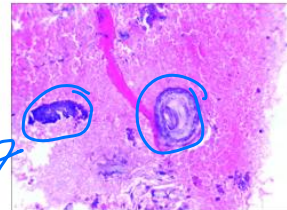
1. Define pathologic calcification and its types.
2. Describe dystrophic calcification and metastatic calcification
3. Discuss various sub cellular alteration.
4. Discuss Fat and pigments accumulation.

Pathologic (or Heterotopic) Calcification

- Deposition of calcium salts in tissues other than bone or enamel is called **PATHOLOGICAL CALCIFICATION.**

Morphological features:

- Macroscopic (Gross): Fine white gritty deposits.
- Microscopic: basophilic granular deposits
blue color



`Types of pathologic calcification

There are two types of calcification :

1. Dystrophic calcification in dead or damage tissue
2. Metastatic calcification in living (healthy) tissue

Q) what is calcium metabolism?

Q) what is the normal serum of calcium?



Dystrophic calcification(DC)

- DC is the deposition of calcium salts in dead or degenerated tissue (injured tissues)

- Seen in areas of necrosis, large arteries & **damaged heart valves**

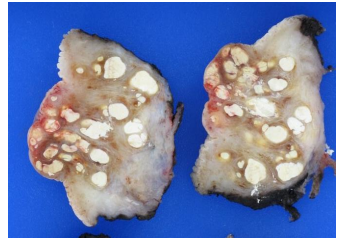
- *• It occurs despite normal serum levels of calcium and in the absence of derangements in calcium metabolism

Conditions that lead to DC

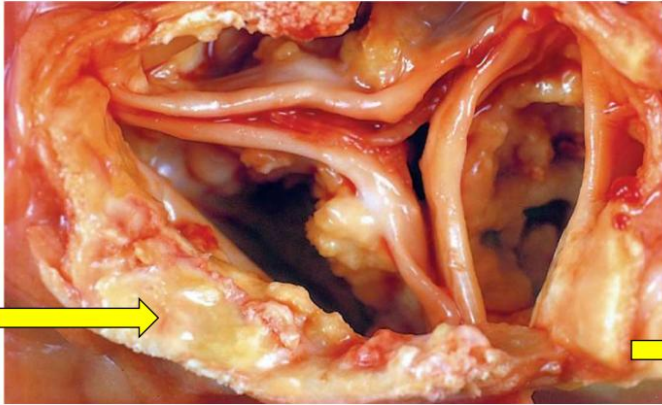
- Calcification is almost always present in the atheromas of **advanced atherosclerosis**
- It also commonly develops in **aging or damaged heart valves.**
- Sometimes a **tuberculous lymph node** is virtually converted to stone.

DYSTROPHIC CALCIFICATION – MORPHOLOGY

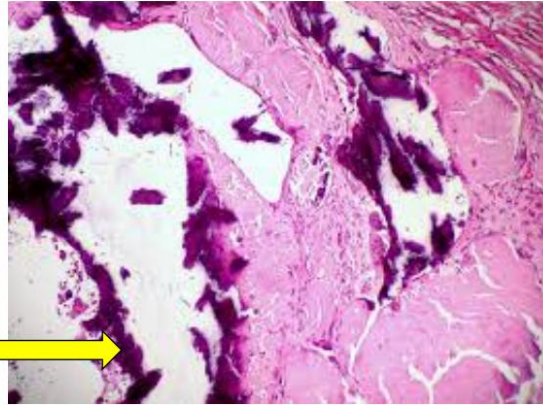
- **GROSS:** The calcium salts appear macroscopically as fine, white granules or clumps, often felt as gritty deposits.
- **MICROSCOPIC:** Histologically, with the usual H&E stain, calcium salts have a basophilic, amorphous granular, sometimes clumped appearance.



Dystrophic calcification of the aortic valves



gross



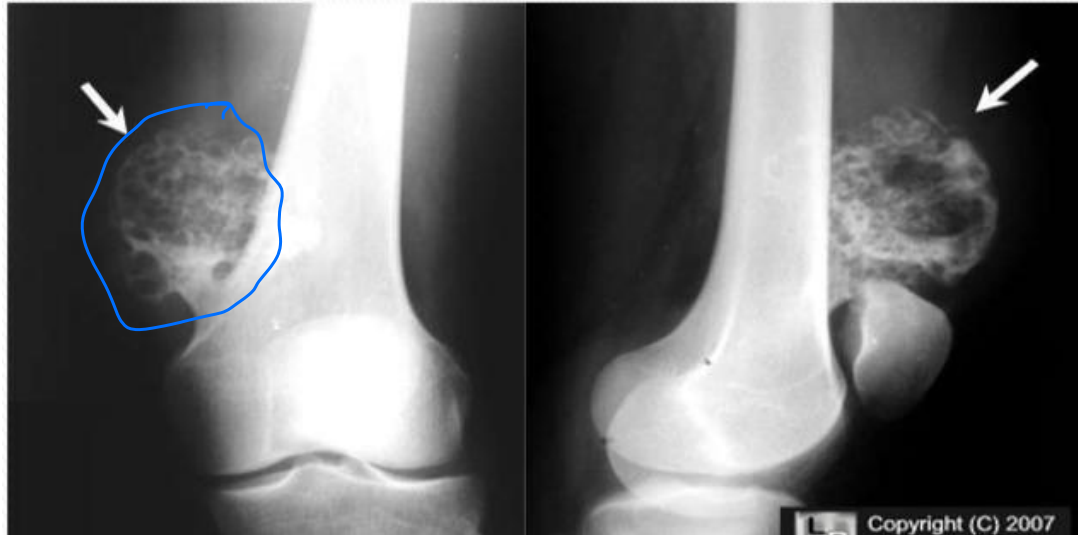
microscopic

2)

Metastatic calcification

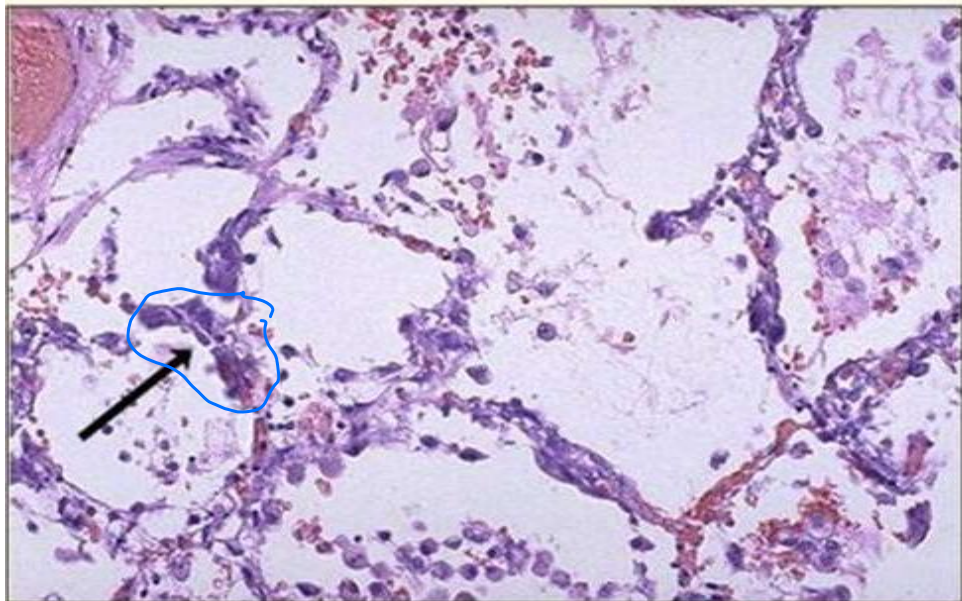
- Metastatic calcification can occur in normal tissues whenever there is Hypercalcemia.
- Any disorder that increases the serum calcium level can lead to **calcification in inappropriate locations.**
- It can occur throughout the body, but commonly seen in gastric mucosa, kidney ,lungs.

The arrow point to deposits of calcium in the
interstitial tissues of both upper lobes



Metastatic Calcification

Hypercalcemia - Lung



Differences between dystrophic and metastatic calcification

	<u>1</u> Dystrophic calcification	<u>2</u> Metastatic calcification
<u>Site</u>	<u>Dead tissue</u>	<u>Normal tissue</u>
<u>Serum calcium</u>	<u>Normal</u>	<u>Hypercalcemia</u>
<u>Calcium metabolism</u>	<u>Normal</u>	<u>Deranged</u> (disturb)
<u>Examples</u>	<u>Abscess wall</u>	<u>Skin</u>

Intracellular Accumulations : Subcellular accumulation

• **INTRA + CELLULAR= INSIDE CELL**

- Metabolic derangements in cells can lead to the intracellular accumulation of abnormal amounts of various substances.
- **Under special circumstances**, cells may accumulate abnormal amounts of substances ^{seen in} within the cytoplasm (especially lysosomes) or nucleus.
- Accumulations can be harmless to the cells, but on occasion they are severely toxic.

Mechanisms of Intracellular Accumulations

1. due to overproduction
2. due to inadequate metabolism
3. lack of enzyme action to remove
poor removable

Fatty change (steatosis)

- Fatty change is any abnormal accumulation of triglycerides (fat) within parenchymal cells.
- It is most often seen in the liver.
- Also can occur heart, skeletal muscle, kidney, other

Fatty change in liver can be due to

1. Excess fat e.g. Obesity, Diabetes mellitus, etc

2. Liver cell damage resulting in inadequate metabolism of fat e.g.
alcohol, toxins, steroids, starvation, protein malnutrition, chronic
illness, etc.

Gross: Liver is enlarged, yellow in color, and greasy to touch

Normal Liver & Cut Section of Fatty Liver

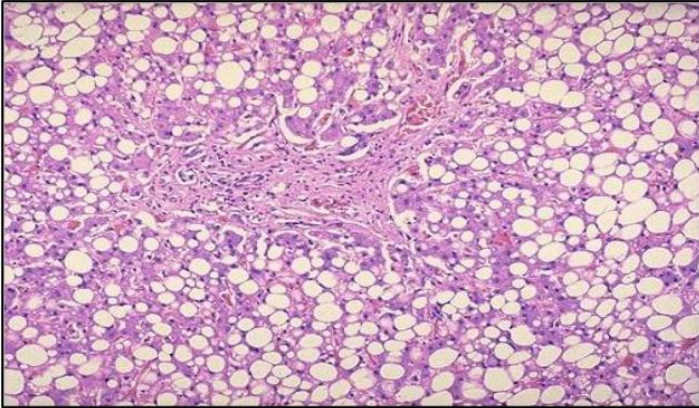


Normal Liver: This is the external surface of a normal liver. The color is brown and the surface is smooth

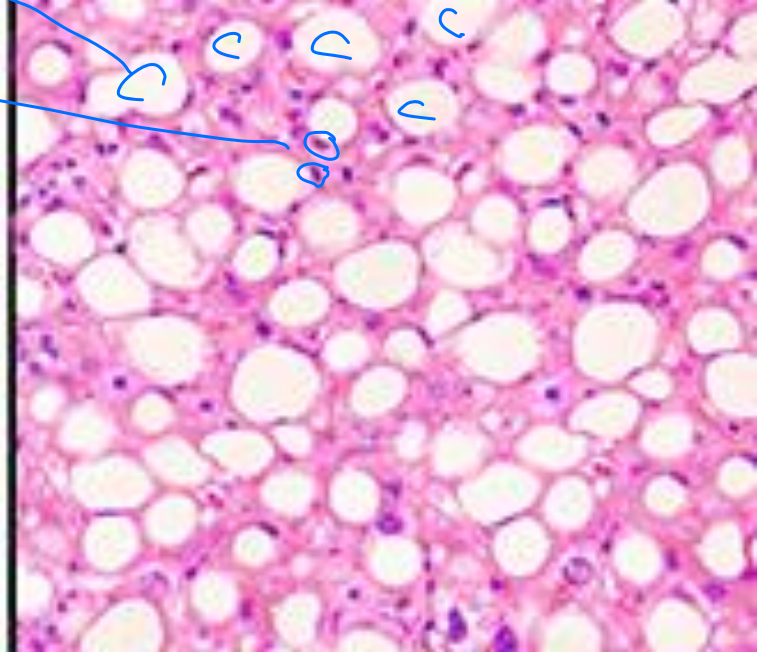


Steatosis: This liver is slightly enlarged and has a pale yellow appearance, seen both on the capsule and cut surface

•Microscopy: **Lipid vacuoles (fat accumulation) in the cytoplasm of hepatocytes**, pushes the nucleus to periphery (giving an empty cell appearance)



This is the histologic appearance of hepatic fatty change. The lipid accumulates in the hepatocytes as vacuoles. These vacuoles have a clear appearance with H&E staining. The most common cause of fatty change in developed nations is alcoholism.



Pigments

- Pigments are coloured substances, some of which are normal constituents of cells (e.g., melanin), whereas others are abnormal and accumulate in cells only under **special circumstances**.

Two types: *of abnormal pigments cells*

1. Endogenous pigments (synthesized within the body itself)
2. Exogenous pigments (from outside the body)

EXOGENOUS PIGMENT (from outside the body)

↳ **Carbon** an air pollutant of urban life and in smokers.

Once inhaled it is taken up by alveolar macrophages, which is coughed out Or it settles in interstitial tissue of lung.

Anthracosis



2-Tattooing

- It is a form of localized, exogenous pigmentation of the skin.
- Dye is taken up by dermis macrophages, and is present indefinitely
Permanent



ENDOGENOUS PIGMENT (synthesized in body)

1. MELANIN

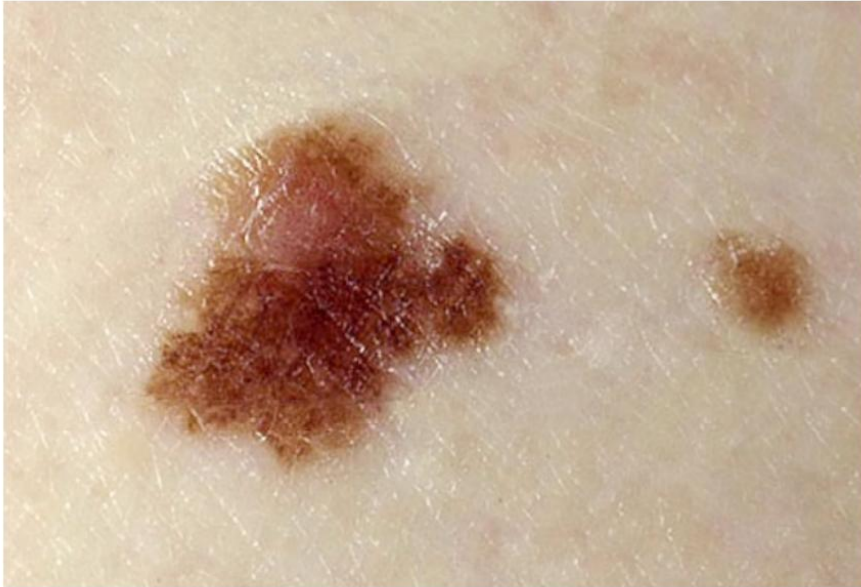
2. HEMOSIDERIN

3. LIPOFUSCIN

ENDOGENOUS PIGMENT (synthesized in body)

- **Melanin** (brown-black pigment produced by melanocytes) is the most common pigment
 - Normally, melanin acts as a shield against harmful UV radiation.
 - But it can be increased in conditions such as nevi, Melanoma, Addison's disease (buccal mucosa pigmentation).
 - It can also be decreased e.g. Vitiligo

Melanoma



Vitiligo

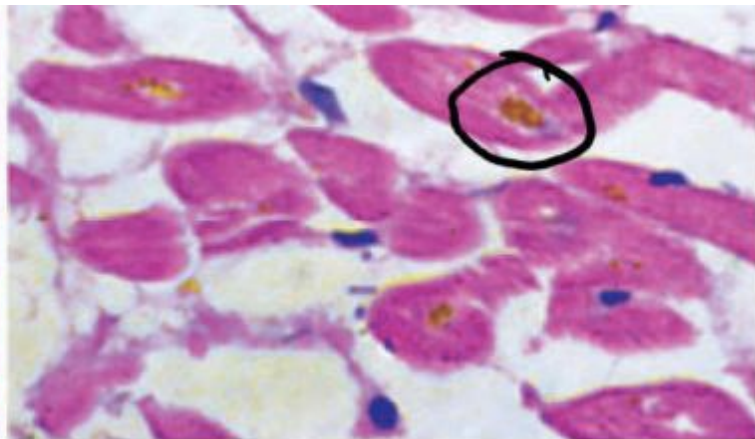
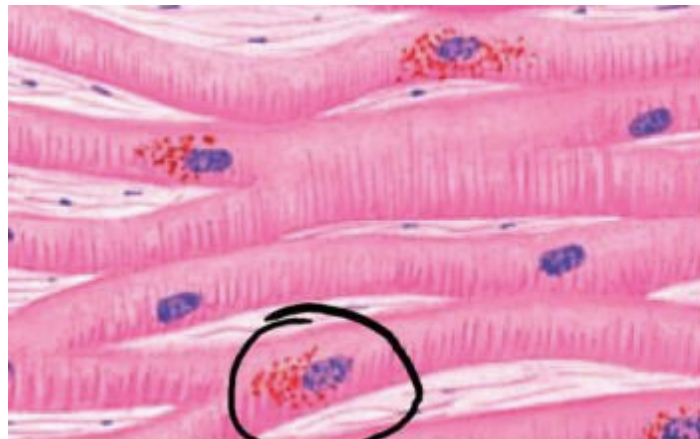


2 - Hemosiderin

- It is a hemoglobin-derived, golden yellow-to-brown pigment that serves as one of the major storage forms of iron.
- Commonly, hemosiderin accumulation occurs when there is increased break-down of RBC, e.g. hemolytic anemias.

Endogenous Pigment - Lipofuscin

- Lipofuscin (lipo-fat; fuscine-brown), or "^{strong}wear-and-tear pigment," is an brownish-yellow intra-lysosomal material that accumulates as a function of ^{Seen in ①}age or ^②atrophy
- Commonly seen in heart, hepatocytes, neurons, etc
- With aging, the phospholipid products, persist as collections of indigestible material (residual bodies) in lysosomes.



Brown atrophy of the heart. The lipofuscin pigment granules are seen in the cytoplasm of the myocardial fibres,

Essential Learning Resource

- **Harsh Mohan: Essential Pathology for Dental Students (with Practical Pathology).** 5th ed; 2017; Jaypee Brothers Medical Publishers
- **Harsh Mohan: Textbook of Pathology.** 7th ed; 2014; Jaypee Brothers Medical Publishers
- **Kumar: Robbins Basic Pathology.** 10th ed; 2017; Elsevier



THANK YOU!