



Pathology

Subject :

Lec no : lec15-

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وَقُلْ رَبِّ زِدْنِي عِلْمًا

Hemodynamic Disorders

2023-2024

Audio 1-2



Objectives of hemodynamics

- Hyperemia
- Congestion and Odema
- Types and causes of odema
- Hemorrhage (types of hemorrhage)
- Thrombosis & DIC
- Embolism. (Types of Embolism)
- Infarction.(Types of Infarction)
 - White infarction
 - Red infarction
- Shock(Types of shock)
 - Hypovolemic shock , Septic Shock
 - Anaphylactic shock
 - Neurogenic shock
 - Cardiogenic shock



Introduction

- ❑ **Hemodynamic disorders** are very **common** & extremely **important cause of clinical illnesses**.
- ❑ The **health of cells & tissues** depends on the circulation of blood , which delivers oxygen & nutrients and removes wastes generated by cellular metabolism .
- ❑ Under normal conditions, as blood passes through capillary beds, proteins in the plasma are retained within the vasculature and there is **little movement of water & electrolytes into the tissues** .
Handwritten notes: absorption & filtration من تحكم قوة هالك في cells & proteins في كل ميكرو-الدم في filtration في حاله Starling force = capillary hydrostatic pressure = oncotic pressure
- ❑ This balance is often disturbed by pathologic conditions that alter endothelial cells function, increase vascular pressure, or decrease plasma protein content, all of which promote **edema** i.e. accumulation of fluid in extra vascular spaces.



□ **Hemostasis** is the process of **blood clotting** that prevents **excessive bleeding after blood vessel damage**.
الدم يتجلط
Primary hemostasis
Secondary =

□ Hemostasis is the mechanism that leads to cessation of bleeding from a blood vessel. It is a process that involves multiple interlinked steps. This cascade culminates into the formation of a “plug” that closes up the damaged site of the blood vessel controlling the bleeding

□ Inadequate hemostasis may result in **hemorrhage** which can affect tissue perfusion & if its massive and rapid; it may lead to hypotension, shock & death.

□ Conversely, inappropriate clotting i.e. **thrombosis** or migration of clot called **embolism** can obstruct blood vessels causing ischemic cell death i.e. **Infarction**.

□ **Thrombo-embolism** lies at the heart of three major causes of morbidity & death in developed countries, **myocardial infarction**, **pulmonary embolism** & cerebro-vascular accidents (CVA) or stroke.



زيادة الدم في
capillaries ← Blood في

HYPEREMIA & CONGESTION

- Both terms, hyperemia & congestion, indicate increased local blood volume in a particular tissue.

- But **Hyperemia** is an **active process**, resulting from increased blood flow due to **arteriolar dilation**, at sites of **inflammation** or in **skeletal muscle during exercise**, & the hyperemic tissue is red.

انحلال

حيث يتجمع الدم في الـ capillaries نتيجة زيادة تدمت الدم من طرف arteriolar side

hyperemia *

- **Congestion** is a **passive process**, resulting from impaired venous return from a tissue. The congested tissue is **cyanotic, bluish-red in color** because congestion leads to accumulation of deoxygenated hemoglobin in the congested tissues.

← ذلك حين active processes arterioles و smooth muscles الموجودة في الـ

hypertemia *

← venules (الدم الخارج من capillaries) ← venules (الدم المتراكم في الـ capillaries) ← venules

Congestion *



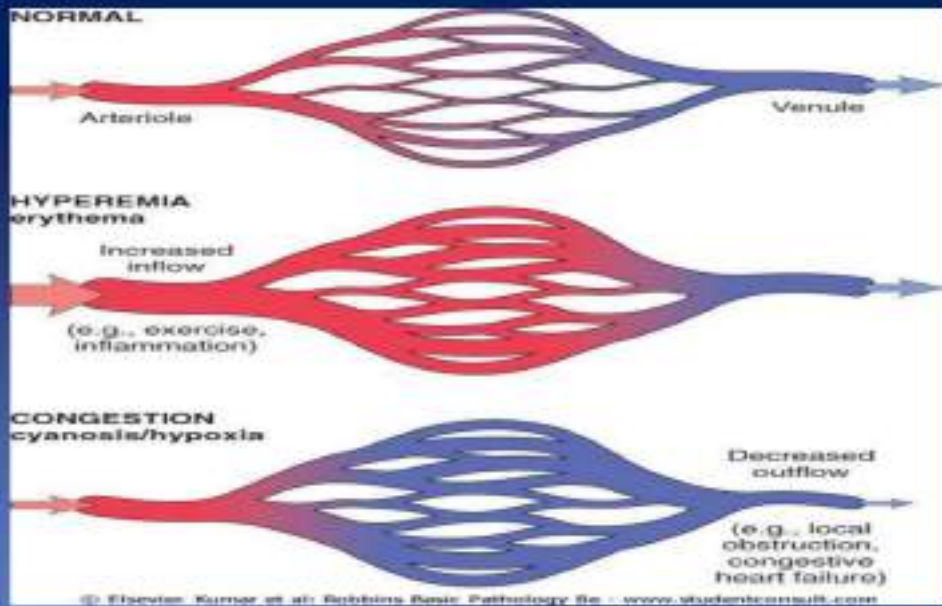


Figure : Diagrammatic view of normal arterio-venous anastomosis , hyperemia & congestion ..



Figure : Gross view of hyperemia of the brain , brain looks reddish .



Figure : Photographic appearance of hyperemia of the inflamed conjunctiva of eye .

Congestion may be

- **systemic**, as in Congestive heart failure, or **localised** resulting from an isolated **venous obstruction**.
- Congestion & edema commonly occur together.
- In long-standing chronic venous congestion (CVC), the stasis of poorly oxygenated blood causes chronic hypoxia, which can result in **paranchymal cell degeneration or death**, & subsequent tissue fibrosis.
- **Capillary rupture** at sites of CVC may also cause small foci of hemorrhage.

للمبدأ موت الخلايا نقص الأكسجين
نزف و نزف
تراكم الدم فيه



Pulmonary congestion :



❑ **Grossly** : The congested lung is **heavy**, **dark red in color** when squeezed a **frothy air-containing fluid** or **blood stained fluid** will be squeezed out.

تقلص

سب (edema) سائل داخلها
فقاعات هواء

❑ Microscopically :

• **Acute pulmonary congestion** is characterized by **alveolar capillaries distension** with blood, **alveolar septal edema** and/or focal minute **intra-alveolar hemorrhage**.

سب تراكم Fluids
سب alveoli

سب تراكم Blood
استعاج

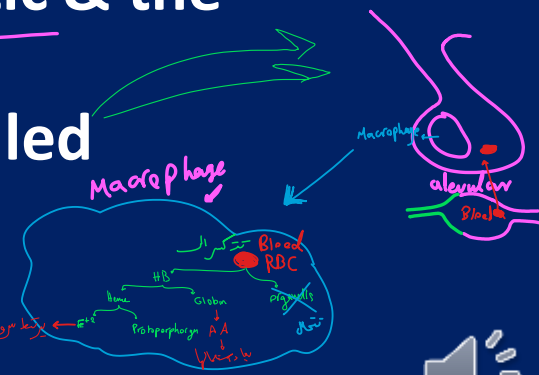
• While in **chronic pulmonary congestion**, the alveolar septa become **thickened & fibrotic** & the **alveolar spaces may contain numerous hemosiderin-laden macrophages**, so-called ("**heart failure cells**").

تقرت
الوسيط capillary

2

تصايرها
heart failure

لدها أكثر سب يودي إلى chronic pulmonary congestion هو



يتجمع ال (Ferritin) مع (hemosiderin)
تراكم ال Macrophages ال



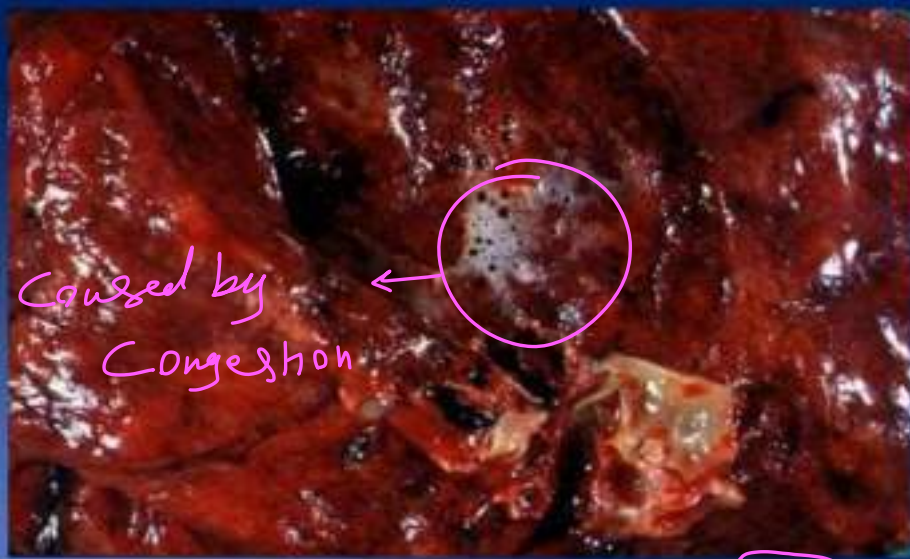


Figure - Gross view of acute lung congestion, lung tissue is dark red with frothy fluid comes out during cutting.

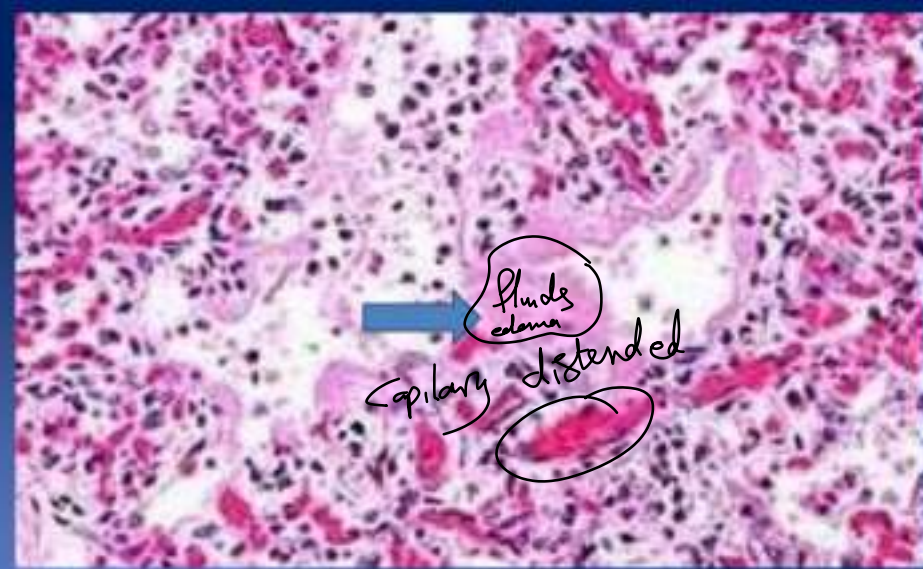


Figure : Microscopic view of acute pulmonary congestion, showing congested capillaries in alveolar septa with intra alveolar edema (arrow).

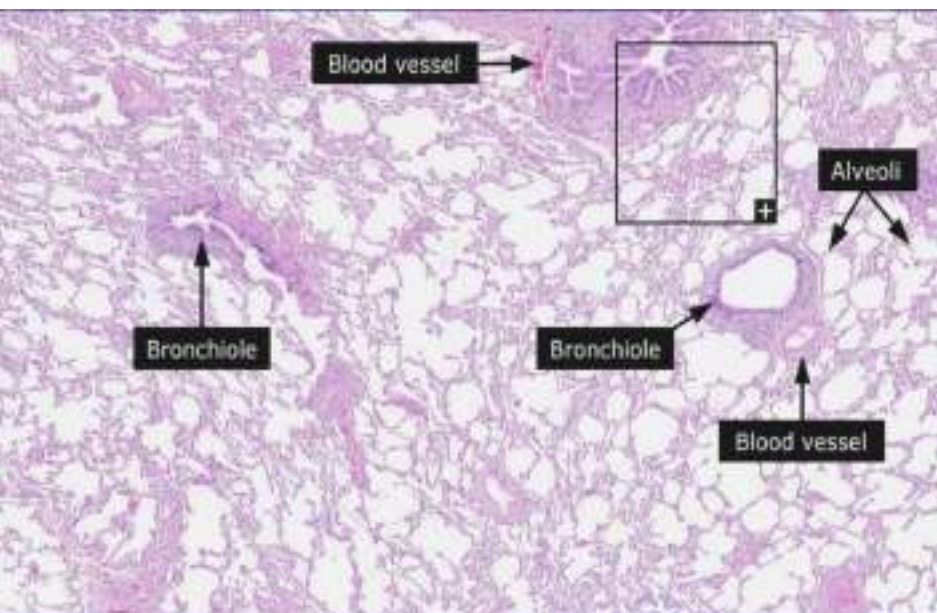


Figure : Normal lung histology

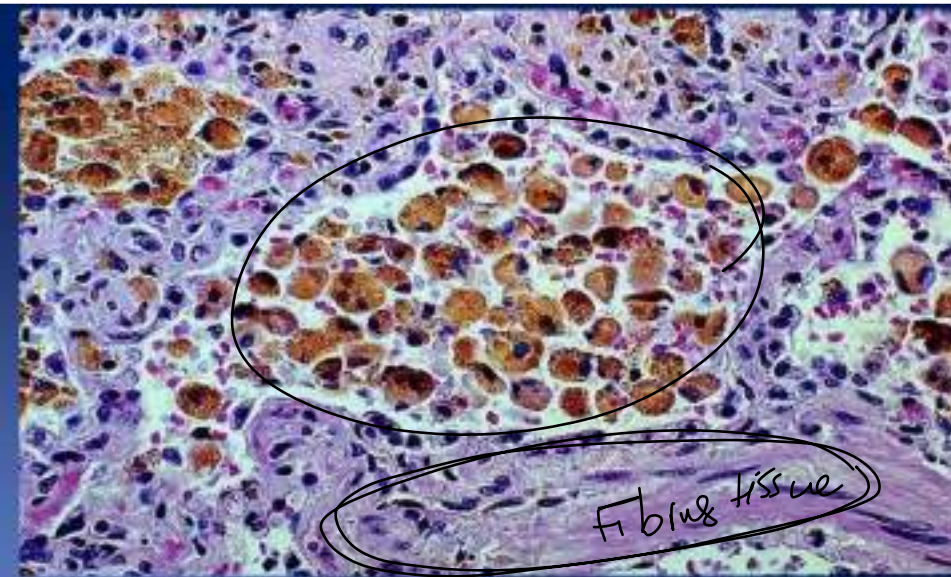


Figure - Chronic pulmonary congestion showing golden-yellow appearance of hemosiderine-laden macrophages i.e. (Heart-failure cells) & fibrosis of alveolar septa.

pearl solution کے ذریعہ (hemosiderin) اگلی سے لے کر

Liver Congestion

- ❑ Congestive hepatopathy is diffuse venous congestion within the liver that results from right-sided heart failure (usually due to a cardiomyopathy, tricuspid regurgitation, mitral insufficiency, cor pulmonale, or constrictive pericarditis).

Grossly : Microscopically

- ❑ There is centri lobular hepatic cell necrosis & hemorrhage, with hemosiderin-laden macrophages , alternating with a pale peripheral zones of fatty change in peripheral hepatocytes . In severe & long-standing hepatic **Central Venous Congestion**(commonly due to heart failure), there may even be grossly evident **hepatic fibrosis, so-called "cardiac cirrhosis"**.

- ❑ In chronic venous congestion the liver have the nut-meg-like appearance, because the central portions of the hepatic lobule is the last to receive blood from both portal vein & hepatic artery, so they tend to undergo early necrosis due to ischemic injury , whenever there is reduced hepatic blood flow with hemorrhage thus look dark red & peripheral zone look pale , due to unaffected hepatocytes or fatty changes .

(reversible injury) ← fatty change
Necrosis ← الموت
من المنتظم يحدث

1

2

3

4

central necrosis ← liver
فatty change ← (pale)
منطقة داكنة في الكبد ← liver
منطقة باهتة ← (pale)



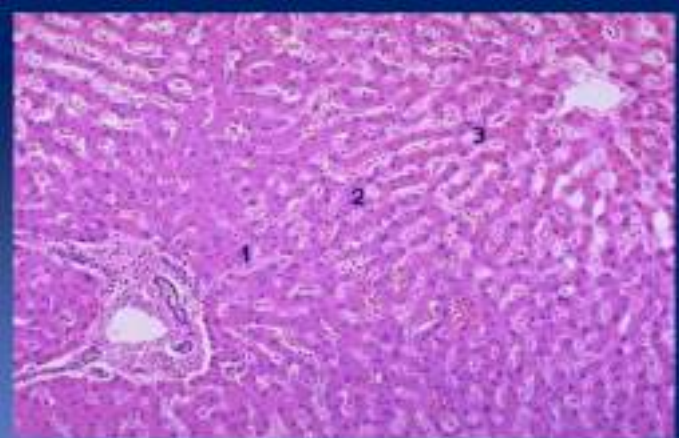


Figure : Normal liver ,microscopic view .



Figure : Nut meg liver in CVC , gross view. The gross pathological appearance of a liver affected by chronic passive congestion is "speckled" like a grated nutmeg ; the dark spots represent the dilated and congested hepatic venules and small hepatic veins. The paler areas are unaffected surrounding liver tissue

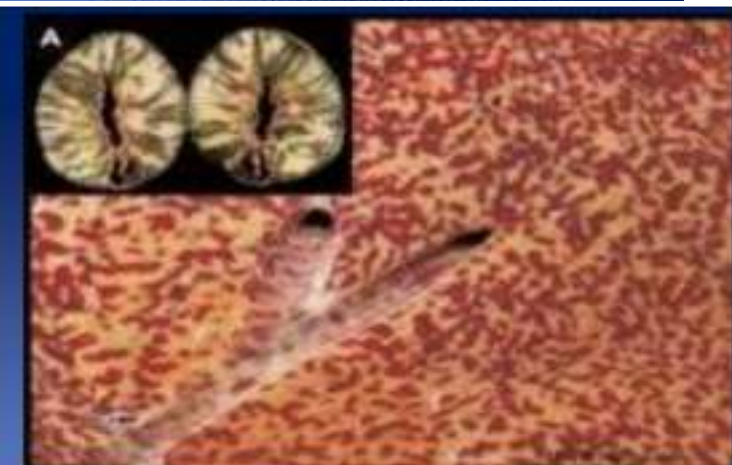


Figure : Nut meg liver in chronic venous congestion due to heart failure .A- Nut meg grain .
Increased systemic venous pressure from any cause lead to hepatic cingestion , liver becomes enlarged, tender &pulsatile

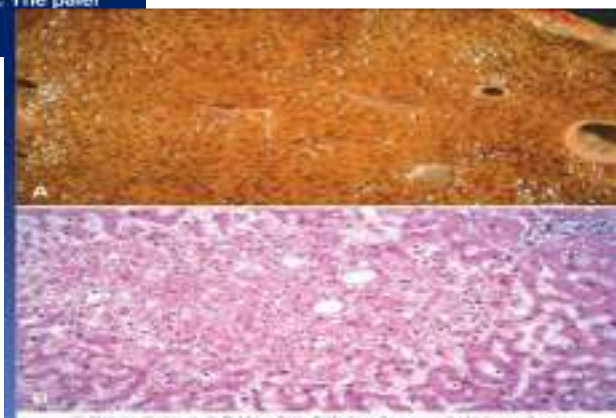


Figure : Gross & microscopic appearances of liver in CVC.

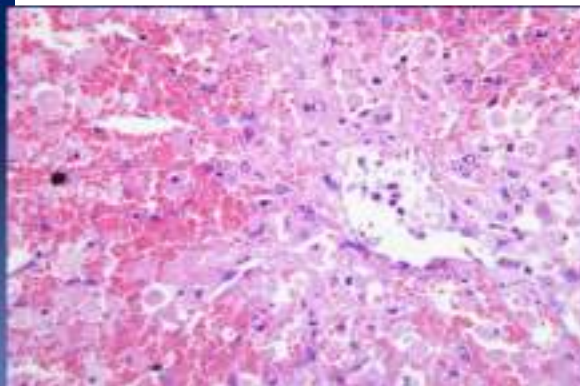


Figure : microscopic view of liver in CVC (nut meg liver)showing necrotic hepatocytes & hemorrhage around central vein giving red color to this area.