

pathology/1st course.

HEAMODYNAMIC DISORDERS



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قسم تقنيات الاشعة والسونار

. Third Stage

المرحلة الثالثة

محاضرة رقم 7&8 الجانب النظري

Lecture
No.7&8

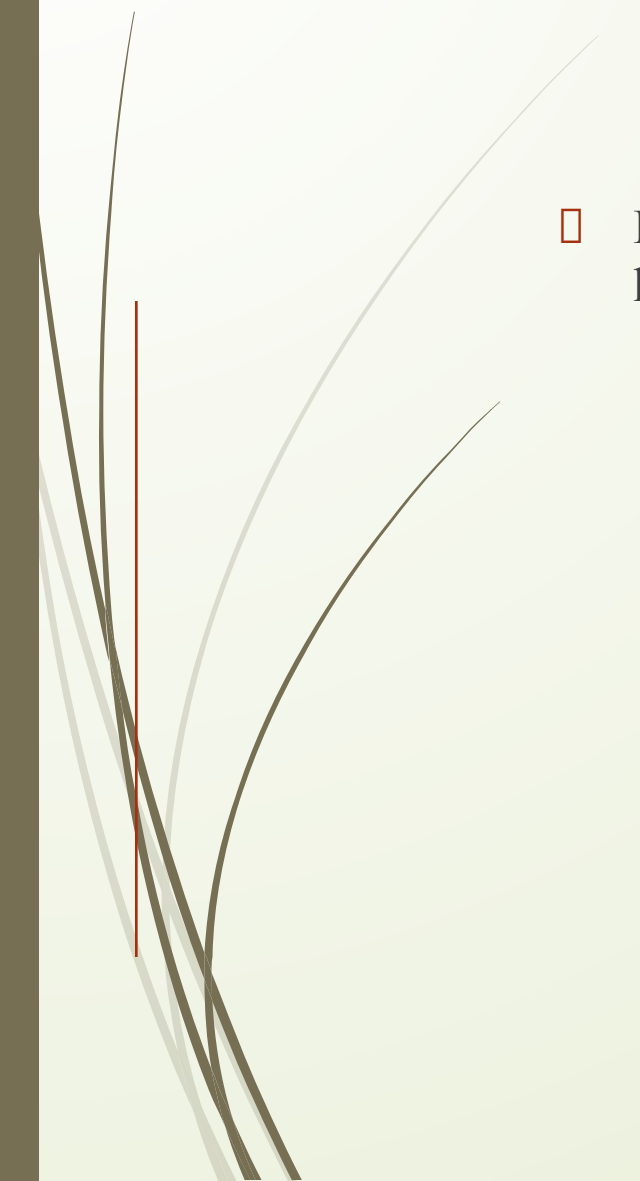
Sawa University

Theoretical

تدريسي المادة : م.م. فاضل عوفي عواد



Homodynamic Disorders: Overview

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- Disturbances in blood flow and fluid balance including hyperemia, congestion, edema, hemorrhage, and hemostasis abnormalities.

Hyperemia and Congestion

1. Hyperemia – Definition, Types, Features

Definition

Hyperemia is an active increase in blood flow within tissues due to arteriolar dilation.

Types

1. Physiologic Hyperemia

Occurs during exercise, fever, or heat exposure.

2. Pathologic Hyperemia

Occurs during inflammation or allergic responses.

- Characteristics
 - Tissue becomes red and warm due to oxygenated arterial blood.
 - Considered beneficial in most cases because it enhances immune cell delivery.
- Hyperemia: Active ↑ blood inflow.
- Congestion: Passive impaired outflow → blue-red tissue.

5 2. Congestion – Definition, Types, Features

- Definition: Congestion is a passive accumulation of blood caused by impaired venous drainage.
- Types
 - 1. Localized Congestion
 - Due to venous obstruction (e.g., thrombosis, compression).
 - 2. Generalized Congestion
 - Mainly caused by heart failure (left or right-sided).

Characteristics

- Tissue becomes blue or purple (cyanotic)
- Low oxygenation leads to cell damage
- Chronic congestion results in fibrosis and impaired organ function

7. 3. Pulmonary Congestion – Mechanism and Features

- Cause
- Mostly due to left-sided heart failure, which increases pressure in pulmonary veins.
- Mechanism
 - • Blood accumulates in pulmonary capillaries
 - • Thickening of alveolar septa
 - • Leakage of red cells → macrophages ingest iron → “Heart failure cells”

- ▣ • Difficulty in gas exchange
- ▣ • Shortness of breath
- ▣ • Risk of pulmonary edema

4. Liver Congestion – Mechanism and Characteristics

- Cause
- Usually the result of right-sided heart failure.
- Mechanism
 - • Central veins become dilated and congested
 - • Peripheral hepatocytes undergo fatty change
 - • Appearance becomes “nutmeg liver”

Characteristics

- ❑ • Chronic hypoxia in liver
- ❑ • Fibrosis around central veins
- ❑ • Impaired liver function over time

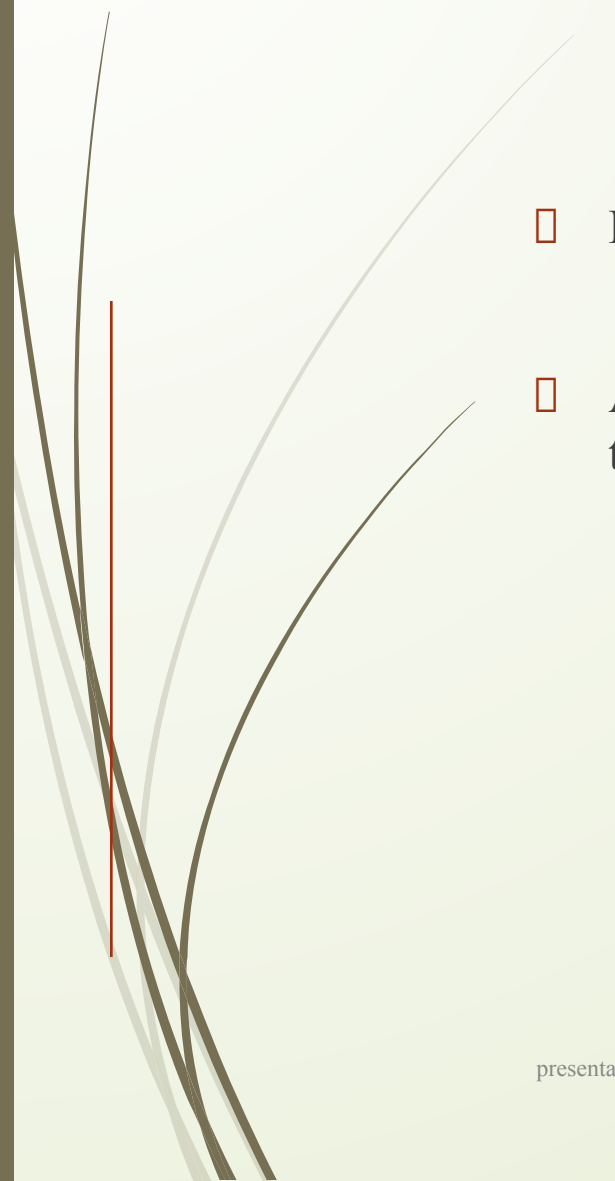
4. Edema – Definition, Causes, Mechanisms

Definition

Edema is the abnormal accumulation of fluid in interstitial tissues or body cavities.

Major Causes

1. Increased hydrostatic pressure
2. Decreased plasma oncotic pressure (albumin loss)
3. Increased vascular permeability
4. Lymphatic obstruction
5. Sodium and water retention



□ Mechanism

□ A shift in the balance between filtration and reabsorption leads to fluid escaping into tissues.

□ Pulmonary Edema – Definition and Effects

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Definition: Accumulation of fluid inside alveoli.

□ Causes

- • Left-sided heart failure
- • Renal failure
- • Acute lung injury (ARDS)

□ Effects

- • Impaired oxygen exchange
- • Frothy, pink fluid in alveoli
- • Severe respiratory distress

□ Cerebral Edema – Types and Consequences

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Definition

□ Excess fluid within brain tissue producing increased intracranial pressure.

□ Types

□ 1. Vasogenic Edema

□ Caused by blood–brain barrier disruption.

□ 2. Cytotoxic Edema

□ Caused by cellular swelling due to hypoxia or toxins.

- Consequences
- • Brain herniation
- • Loss of consciousness
- • Life-threatening pressure on brainstem

□ Ascites – Definition, Mechanism, Clinical Importance

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Definition Accumulation of fluid in the peritoneal cavity.

□ Mechanism

- • Portal hypertension
- • Reduced albumin synthesis
- • Renal sodium retention
- • Increased hydrostatic pressure in abdominal vessels

□ Importance

- Strongly associated with chronic liver disease, especially cirrhosis

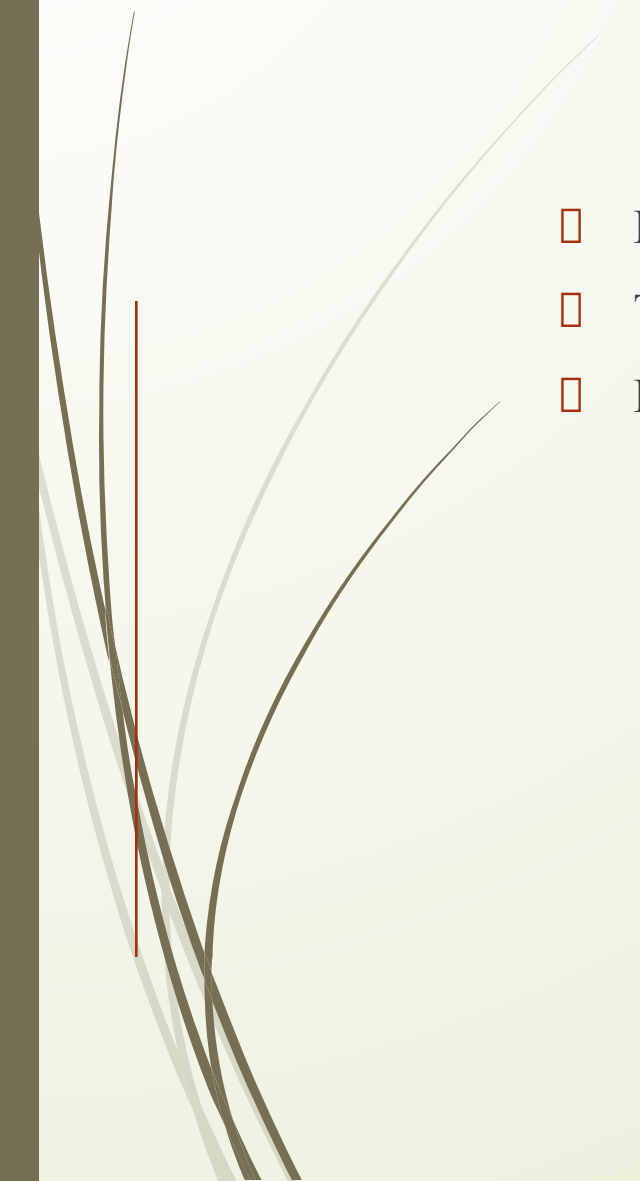
Hemorrhage

- Definition(Escape of blood from vessels into tissues or cavities).
- Types
 - • Petechiae: pinpoint bleeds
 - • Purpura: larger than petechiae
 - • Ecchymosis: bruises
 - • Hemothorax / Hemoperitoneum / Hemopericardium
 - • Intracranial hemorrhage (most dangerous)

- Causes
 - • Trauma
 - • Platelet disorders
 - • Vitamin K deficiency
 - • Clotting factor defects
 - • Vascular injury



Hemostasis and Thrombosis



- Hemostasis: Prevents bleeding.
- Thrombosis: Pathologic clot.
- Key: Endothelium, platelets, coagulation cascade.



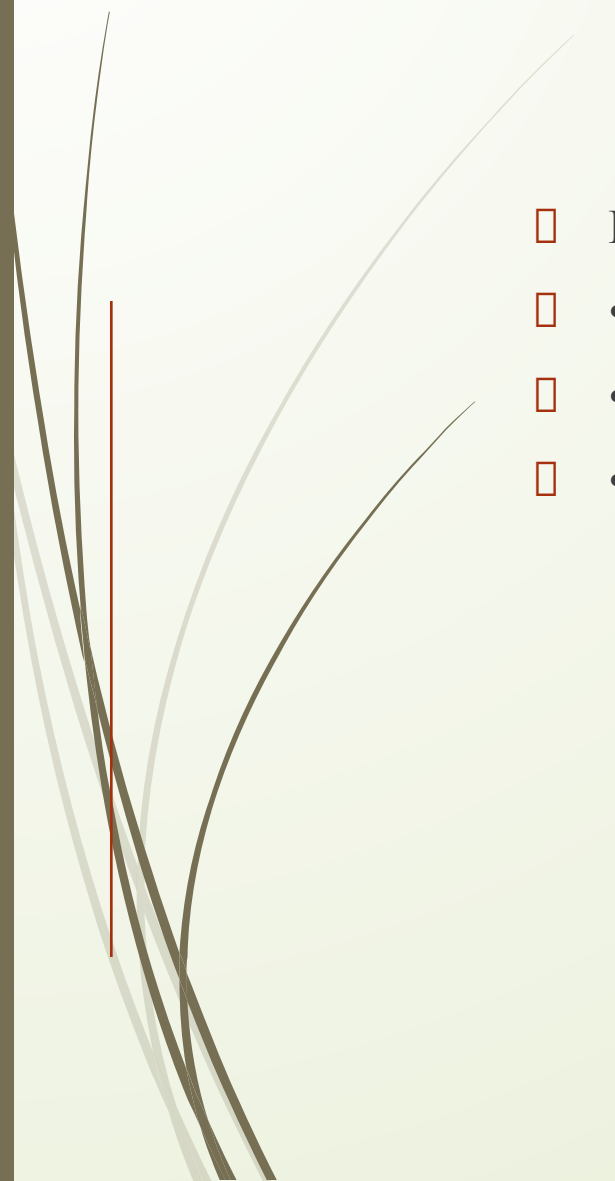
Prothrombotic Endothelium



- Injury causes:
- • ↑ Tissue factor
- • ↓ Thrombomodulin
- • ↑ PAI
- • ↑ Adhesion molecules

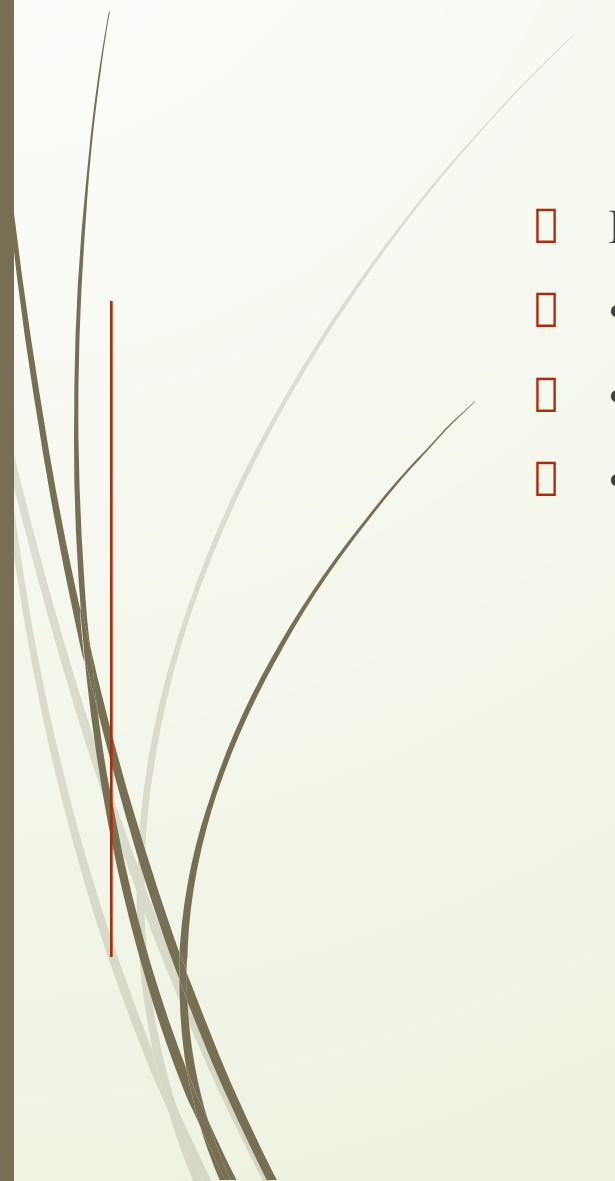


Primary Hemostasis Disorders

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- Platelet plug defects:
 - • Thrombocytopenia
 - • vWD
 - • Platelet dysfunction



Secondary Hemostasis Disorders

- 
- Fibrin defects:
 - • Factor deficiency
 - • Vit K deficiency
 - • Liver disease



Slide Examination Guide



- Identify:
- • Hyperemia vs congestion
- • Edema
- • Hemorrhage
- • Thrombi types
- • Lung & liver congestion



Summary



- Homodynamic disorders include:
 - • Hyperemia & Congestion
 - • Edema
 - • Hemorrhage
 - • Hemostasis & Thrombosis
 - • Primary & Secondary hemostasis disorders
- They reflect systemic disease and appear clearly on histopathology slides.



Hematoma – Definition and Significance

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- Definition:
 - Localized mass of blood within tissues due to vessel rupture.

 - Significance:
 - • Can be minor (skin bruise)
 - • Can be fatal (intracranial hematoma)



Thrombosis – Definition and Fundamentals

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- Definition:
 - Formation of a solid blood clot (thrombus) within intact blood vessels.

 - Virchow's Triad:
 - 1. Endothelial injury
 - 2. Abnormal blood flow (stasis or turbulence)
 - 3. Hypercoagulability

 - Thrombosis results from one or more of these abnormalities.



Endothelial Injury – Causes and Effects



□ Causes:

- • Hypertension
- • Atherosclerosis
- • Smoking
- • Diabetes
- • Inflammation
- • Toxic exposures

□ Effects:

- • Platelet adhesion and activation
- • Activation of coagulation cascade
- • Formation of fibrin-rich thrombus



Abnormal Blood Flow – Stasis, Turbulence

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- Stasis:
 - Occurs mainly in veins (immobility, varicose veins).
 - It allows platelets to contact endothelium, increasing clot risk.
 - Turbulence:
 - Occurs mainly in arteries (atherosclerotic plaques).
 - It causes endothelial activation and platelet aggregation.



Platelets – Function and Components

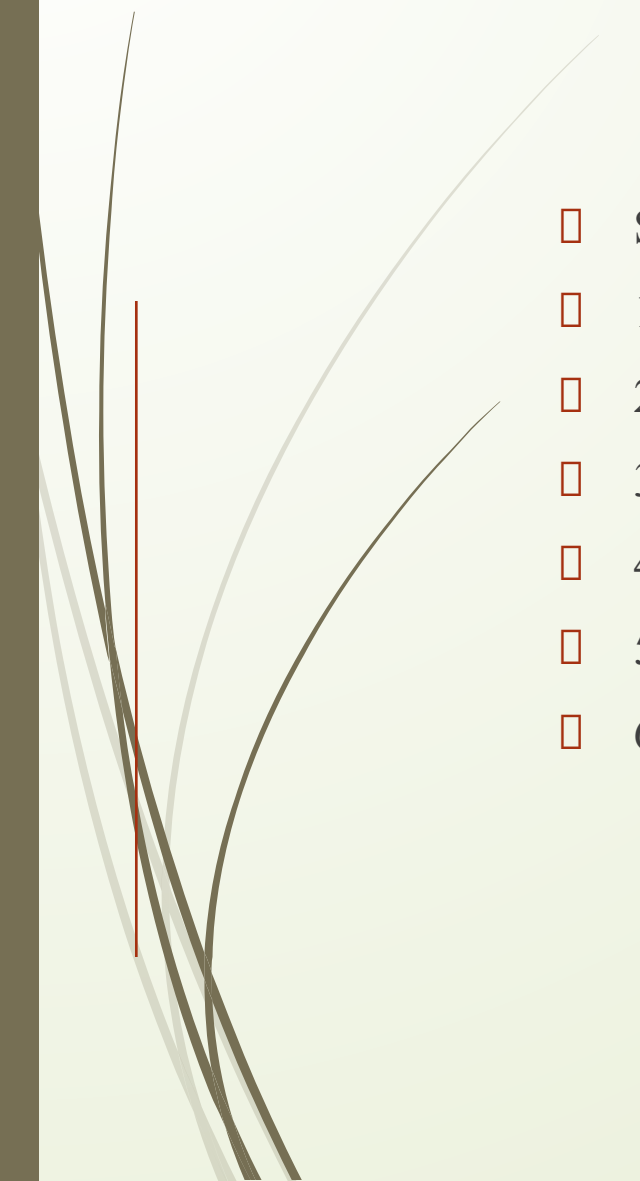
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- Function:
 - Platelets form the primary hemostatic plug.

 - Key Steps:
 - • Adhesion
 - • Activation (release of mediators)
 - • Aggregation → platelet plug

 - Granules:
 - • Alpha granules: growth factors, fibrinogen
 - • Dense granules: ADP, calcium, serotonin

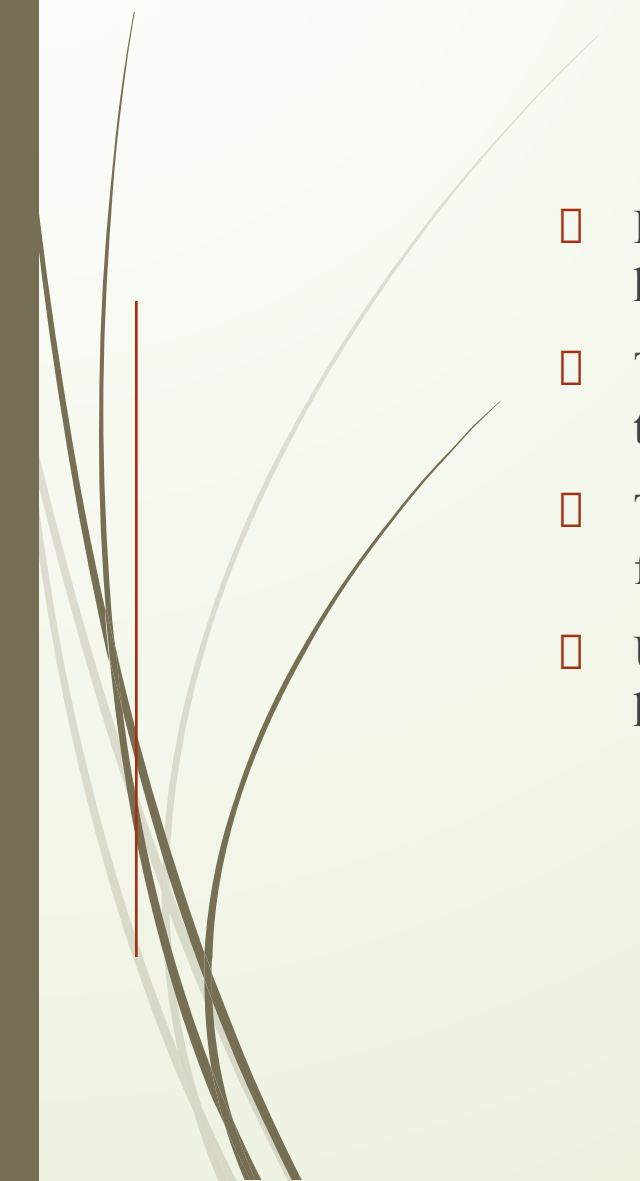


Vascular Response After Injury – Sequence

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- Sequence of Events:
 - 1. Reflex vasoconstriction
 - 2. Platelet adhesion to exposed collagen
 - 3. Platelet plug formation
 - 4. Coagulation cascade activation
 - 5. Fibrin mesh formation
 - 6. Clot stabilization and tissue repair



Overall Summary



- ❑ Hemodynamic disorders include abnormalities in blood flow, vascular pressure, and hemostasis.
- ❑ They manifest as hyperemia, congestion, edema, ascites, hemorrhage, hematoma, and thrombosis.
- ❑ The central pathological mechanisms involve impaired venous drainage, endothelial injury, fluid imbalance, and coagulation disturbances.
- ❑ Understanding these processes provides the foundation for interpreting cardiovascular, hepatic, pulmonary, and renal pathology.

اختبار سريع / Quiz

- ❑ 1. ما الفرق بين Hyperemia و Congestion؟
- ❑ 2. ما السبب الأكثر شيوعًا لحدوث Pulmonary edema؟
- ❑ 3. Chronic pulmonary congestion؟ ما العلامة النسيجية المميزة لـ.
- ❑ 4. Primary hemostasis؟ ما العامل الأساسي في.
- ❑ 5. في فشل القلب؟ Nutmeg liver لماذا يظهر مظهر.

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Any questions?

*Thank
You*