



Course: Radiographic pathology
General pathology (Cell death -Inflammation –Vascular pathology- Shock)
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Pathology

What is pathology (Definition):

Pathology is the study of the cause of disease and the way in which the normal structure and functions of the body are altered by it.

- دراسة سبب المرض
- دراسة تغير التركيب الطبيعي والوظيفة الطبيعي

دكتورة حنان حادي

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لا إله إلا الله والصور

The causes of diseases

There are 2 basic factors which cause diseases:

- 1- Chromosomal and genetic factors, (Hereditary). ^{وراثي}
- 2- Environmental factors, (Acquired). ^{بيني}

Chromosomal and genetic factors

Each human cell has 46 Chromosomes.

Chromosomes are arranged in pairs :
pair 1.....to pair 23.



Genes cont.

Genes are the units of hereditary, located along the chromosomes.
Genes carry factors which cause the disease and so pass the disease from one generation to next generation. E.g. Haemophilia, Thalassaemia and Albinism.

genes → unit of hereditary
→ are located along chromosome
→ carry factors which cause dz

عند الحامل

١٤ (الحمية الأظانية)

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Congenital anomalies

Congenital anomalies (diseases) are malformations which occur when the embryo is growing in the uterus, signs and symptoms may be evident at birth or later in life.

التشوهات الخلقية
مشاكل يولد في جنين
الذي يولد في الرحم

2 main causes of Congenital anomalies:

1- Chromosomal or genetic causes as Down's syndrome (Mongolism) and hemophilia.

العلل = الأعراف
تظهر عند الولادة أو بعد

2- Teratogenic agents as:

- 1- Drugs given to pregnant mothers as thalidomide (used in TTT of Leprosy).
- 2- Infections in pregnant mothers as Rubella.
- 3- Exposure to X ray.

التعرض لل

• X-ray

دواء الـ

thalidomide

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بأن في الحمل نقي

Nausea
لحمج الـ

ولكن تب في صدمة تشوهات

رغم استخدام لحمج الجنام .

Cellular physiology and pathology

To understand diseases of the body systems or individual organs, requires knowledge of the function and dysfunction of individual cells.

The cell is the smallest unit of the body.

-Group of cells forms tissue → organ → system,
e.g. respiratory system and digestive system.

خلايا معروف

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Cell damage

Definition: Irreversible breakdown of the energy function of the cell associated with series of morphological changes following lethal injury.

A wide range of noxious agents can damage the cell (Causes of cell damage).

- أجسام الغريبة الضارة
- 1-Reduced O₂ supply: as in respiratory diseases.
 - 2-Physical agents: as in excessive heat or cold.
 - 3-Chemical agents : as in industrial process.
 - 4-Toxines: produced by bacteria or animals.
 - 5-Viruses.
 - 6-Abnormal immunological reaction: as in hypersensitivity reactions.
 - 7-Nutritional deficiency: as in vitamin deficiency.
 - 8-Genetic abnormality: as in Down's syndrome.

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lethal injury → breakdown of energy function
→ Morphological changes

Inflammation

Definition: It is the dynamic process by which living tissues react to injury.

ردة فعل الأنسجة الحية على الإصابة
عوامل تؤدي إلى

Causes: Various agents may kill or damage cells.

(قتل الخلايا)
أثر إصابة الخلايا

Types of inflammation: acute, subacute and chronic.

initially

- The inflammatory reaction takes place in the surviving adjacent vascular and connective tissues.
- The initial stages are known as the acute inflammatory reaction, when the process is prolonged the inflammation may be subacute or chronic.

if process is prolonged

التغيرات على مستوى
Microscopic

Acute inflammation

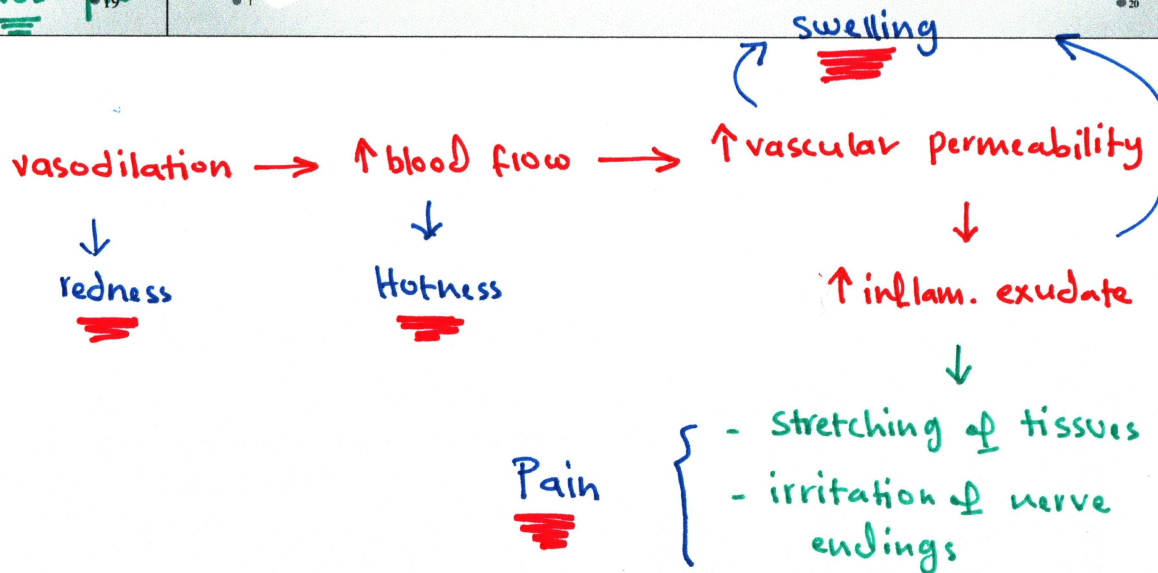
gross signs
Microscopic signs

Cardinal signs of acute inflammation: (gross signs)

- Redness: due to vasodilatation. E.G. Boil.
- Hotness: due to increased blood flow.
- Swelling: due to increased vascular permeability and accumulation of inflammatory exudate.
- Pain: due to stretching of tissues and irritation of nerve endings by mediators as prostaglandins, bradykinin, and serotonin.
- Loss of function: due to pain, swelling and tissue damage.

These gross signs are explained by changes occurring at microscopic level.
Three essential features:

- 1-Hyperemia. 2-Exudation of fluid. 3-Emigration of leucocytes.



Function of inflammation:

- 1- localize the area of injury. تد الإصابات
- 2- Allows the body to resist further injury. تسمح للجسم بمقاومة
- 3- Clears away cellular debris. التخلص من النفايات

Sequae of acute inflammation:

- 1- Resolution. نتائج الالتهاب الحاد
- 2- Suppuration. طب
- 3- a- Repair and organization. تكوّن جديد
- b- Fibrosis. إصلاح / ليف
- 4- Chronic inflammation. التهاب مزمن

Morphology of acute inflammation

The acute inflammation response results in production of exudates.

- An exudate is an edema fluid with high protein content, which frequently contains acute inflammatory cells.
- A transudate is usually a non inflammatory edema caused by cardiac, renal and nutritional disorders.

Exudate

infram. edema
 $> 3 \text{ g/dL}$ high protein content
 alot of cells

- TB / السل
 - pneumonia
 - lung cancer
 - acute pancreatitis
 - Mets
 - pul. infarction
- Pus / infection / inflam.

cloudy / pus
 / clots on standing

Transudate

non inflam. edema
 low protein content $< 3 \text{ g/dL}$
 few cells

cardiac - renal - nutritional
 edema.
 HF → constrictive pericarditis
 → anemia
 nephrotic syn.

clear / faintly yellow
 watery fluid.

Morphologic types of acute inflammation: (suppurative & non-suppurative).

Suppurative (purulent):

Characterized by formation of pus.

Pus is a thick creamy liquid, yellowish or blood stained, composed of: Large number of living or dead leucocytes. (1)

(2) Necrotic tissue debris. Bacteria. Edema fluid

تفتت = لينجوتية



1-4
عقدات
الحمى

There are two types of suppurative inflammation:

Localized:

- Abscess.
- Furuncle.
- Carbuncle.

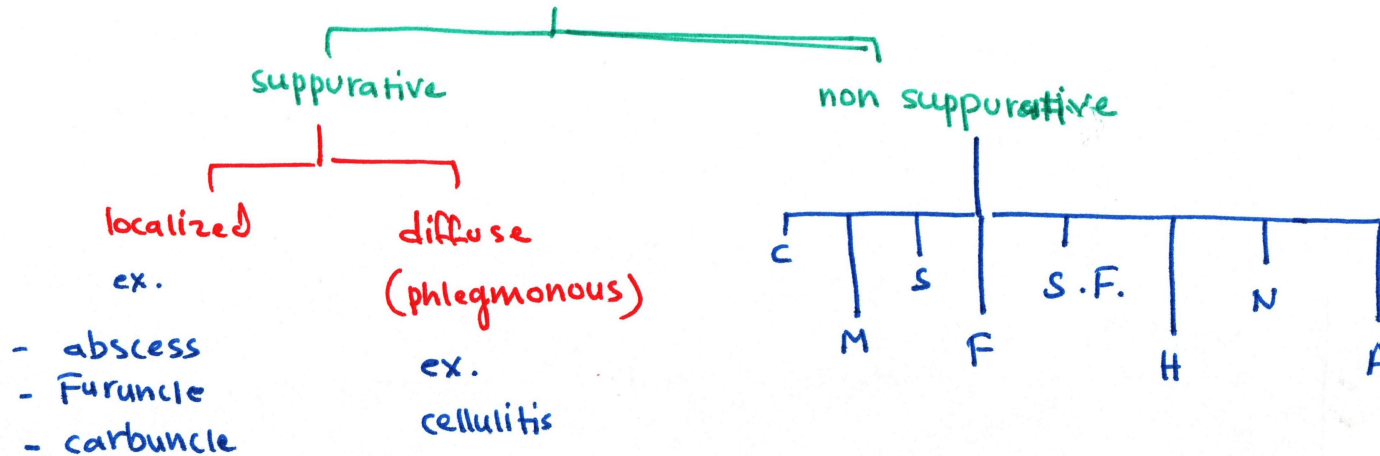
Diffuse (phlegmonous):

- Cellulitis.

• Non-suppurative:

- Catarrhal.
- Membranous.
- Serous.
- Fibrinous.
- Sero-fibrinous.
- Hemorrhagic.
- Necrotizing.
- Allergic inflammations.

Types of acute inflam.



Thrombosis

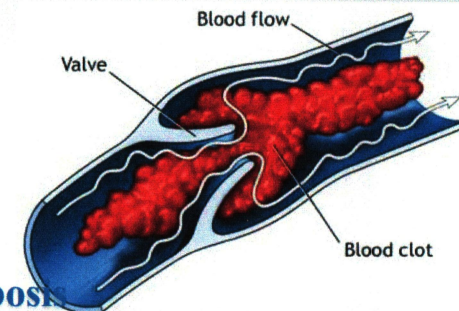
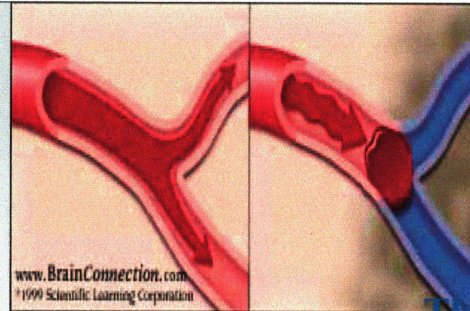
Definition: thrombus is a mass formed from blood components within a vein, an artery or the heart. *كتلة من مكونات الدم في الوريد / الشرايين / القلب*

Mechanism of thrombus formation:

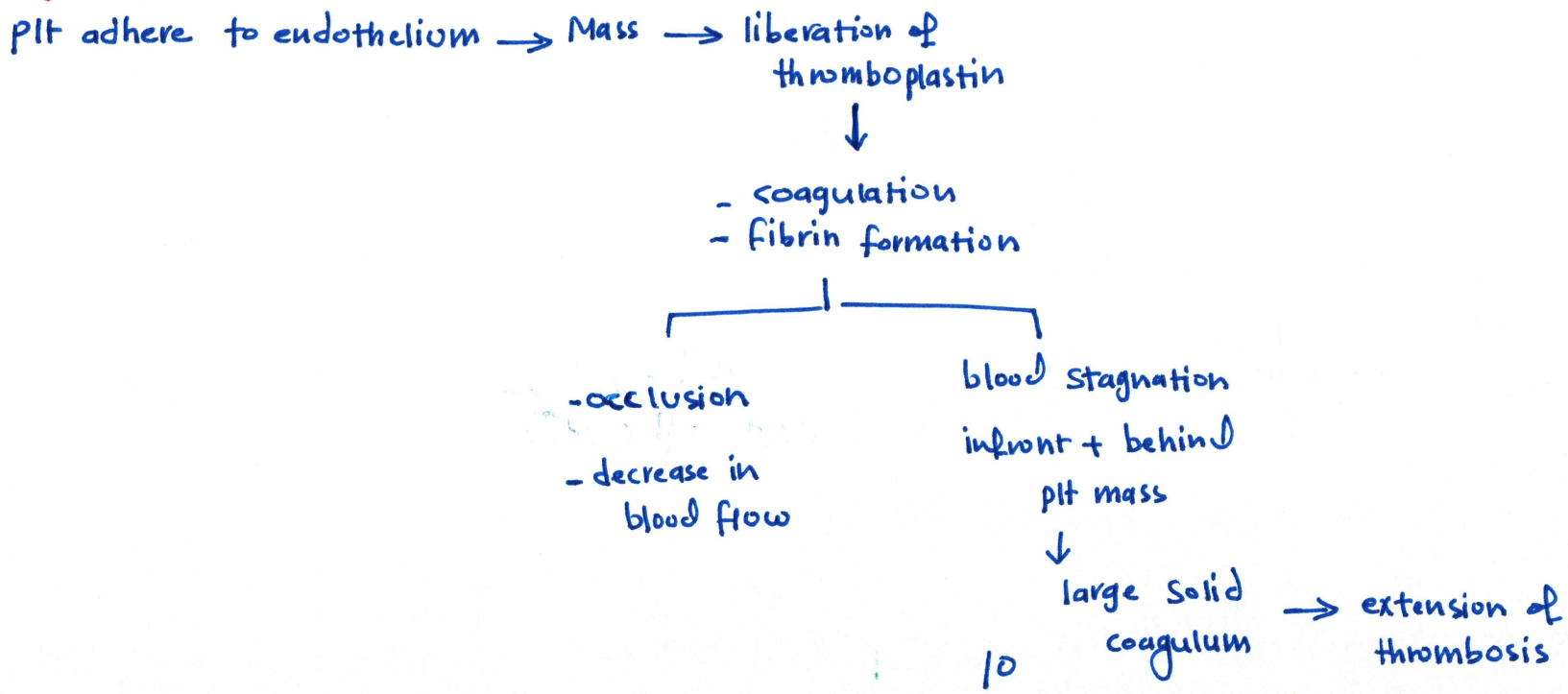
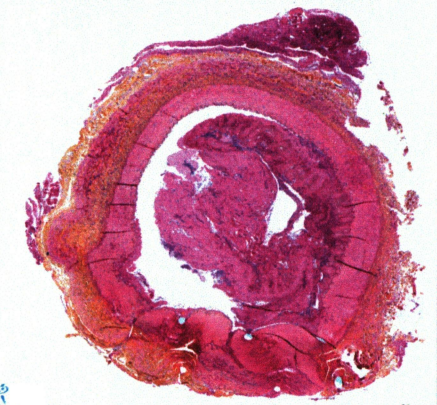
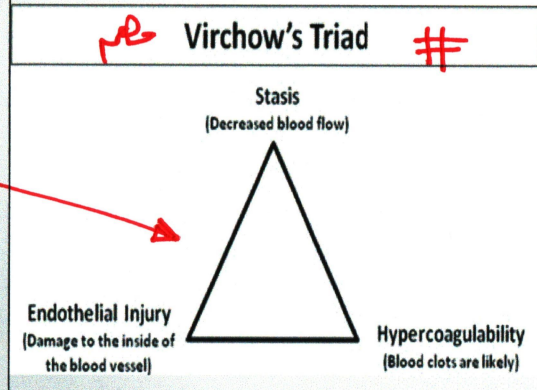
- 1-platelets adhere to endothelium forming a mass with liberation of thromboplastin leading to coagulation and fibrin formation.
- 2-With decrease of blood flow occlusion of the lumen occur.
- 3- Blood stagnation in front and behind the platelet mass forms large solid coagulum, then extension of thrombosis to next vessel.

Factors leading to thrombosis (Virchow's):

- 1-Slowing and turbulence of blood flow. *بطء / اضطراب تدفق الدم*
- 2-Damage to vessel endothelium.
- 3-Change in blood components. e.g:-
 - Increased fibrinogen and prothrombin (after operation).
 - Increased platelets adhesiveness (after operation). *زيادة اللصاق p1ts*
 - Other causes as smoking and oral contraceptives.



Thrombosis



Common sites and types of thrombosis:

- 1-Arterial: atheroma in brain and heart. انس / الأوردة / كبدية انس / الدماغ / القلب
- 2-Systemic: as in deep veins (calf, femoral and popliteal veins), Portal in hepatic cirrhosis. ↑ veins
- 3-Capillaries. ↑ veins
- 4-Heart.

Prophylaxis and therapy of thrombosis:

- 1-Aspirin to inhibit prostaglandin formation, (prophylactic).
- 2-Anticoagulant (Heparin therapy) to decrease coagulability.
- 3-Fibrinolysin.

العلاج الوقائي / علاج التخثر

كيفية العلاج

- قشرة دهنية -
- قشرة غازية
- قشرة في حال إدمان الأروية
- قشرة أورام / قشرة طفيلية

Embolism قشرة متحركة

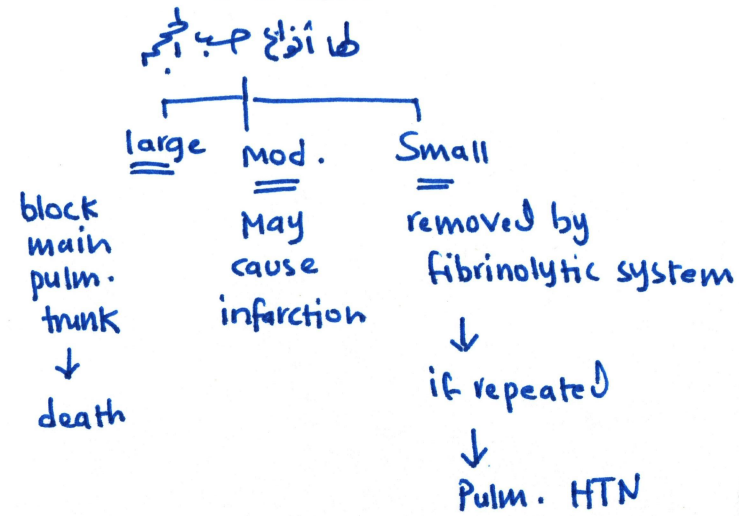
Definition: Abnormal mass carried by the blood stream and large enough to occlude some vessel.

TYPES:

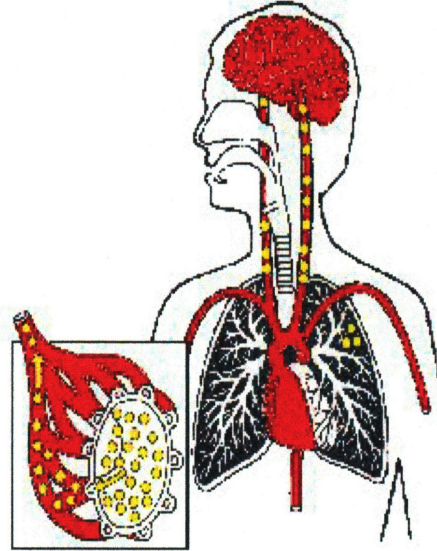
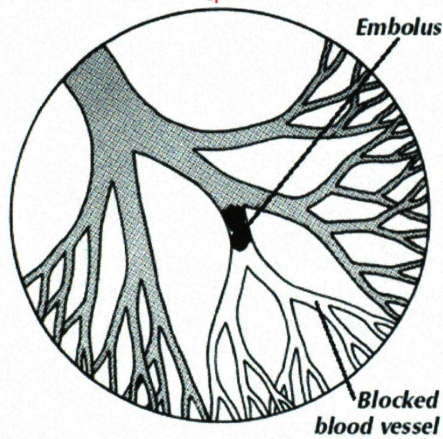
- 1-Pulmonary thrombo-embolism: from deep veins to Rt side of the heart to pulmonary circulation and depend on the size of emboli:
 - a-Large: block main pulmonary trunk leading to death.
 - b-Moderate : with double blood supply (pulmonary and bronchial) may cause infarction.
 - c-Small: removed by fibrinolytic system but if repeated, it may cause pulmonary hypertension.
- 2-Emboli of arterial system: either from great or moderate artery cause arterial obstruction.
- 3-Other types:
 - A-Fat embolism after long bone fracture(long period of immobilization).
 - B-Gas embolism.
 - C-Amniotic fluid embolism.
 - D-Embolism in drug addiction.
 - E-Tumours and parasites (Caisson's disease).

↑ قشرة سائل
الأمينية

Pulm. Embolism (from DVT to Rt side of heart → pulm. circulation)



Embolism cont.



Ischemia

Definition: state in which the arterial perfusion of organ or tissue is lowered than its metabolic needs. *أزسيميا*

Local causes of ischemia:

1- Thrombosis.

2- Embolism.

3- Atherosclerosis.

4- Arterial or venous wall spasm.

5- Outside pressure.

Examples of sites and signs of ischemia:

1- Heart — angina. / infarction

2- Brain — ischemic / infarction.

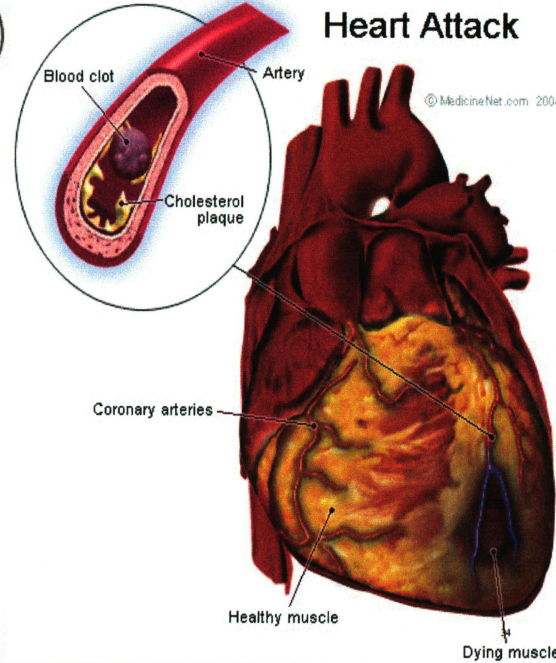
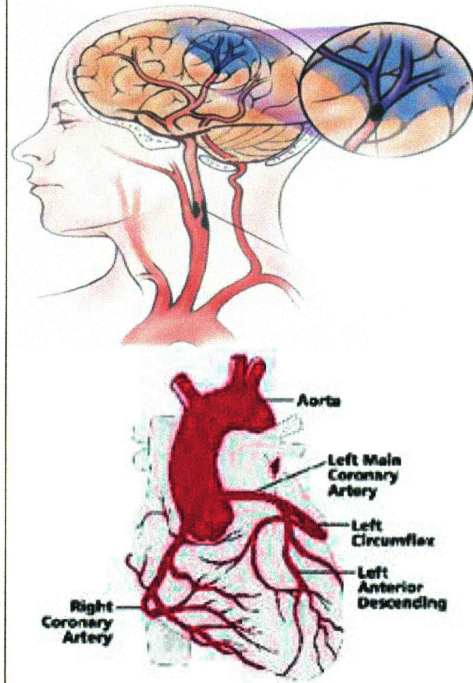
3- Lower limb — intermittent claudication and gangrene.

4- GIT — ischemic enterocolitis and gangrene.

نقص التروية الدموية → ischemia

موت الخلايا بسبب نقص التروية الدموية → infarction

Ischemia cont.



Infarction

Definition: area of necrosis due to ischemia and mostly seen at periphery of an organ.

Stages: blocked artery

After 12 hours there is pale area (degenerative changes).

-After 36 hour there is pallor, swelling & congestion of surrounding tissue (Coagulative necrosis). → in MI (heart)

-Healing----slowly when the capillaries and fibroblasts replace necrotic tissue----collagen formation -----scar.

Common sites:

1-Heart, lung & brain (common sites).

2-Small intestine, kidney and spleen (less common).

✓-Heart: due to coronary artery thrombosis (atheroma).

✓-Brain: liquefactive necrosis. → in stroke (brain)

✓-Intestine: mesenteric artery occlusion---ischemia---congestion---Bacterial infection-----gangrene.

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degenerative changes ← بعد 12 ساعة

Coagulative necrosis { Pallor
Swelling
Congestion ← بعد 36 ساعة

scar ← بعد فترة

Edema

تراكم السوائل خارج الأوعية الدموية

Definition: accumulation of excess of fluid extra vascular.

Mechanisms of odema: نقص الضغط الأزموسى / الانكسار

A-Decrease in blood osmotic pressure due to hypoalbuminemia:

1- Liver diseases---decrease synthesis of albumin. نقص صناعى الألبومين

2- Renal diseases---protein loss in urine. فقد البروتين في البول

B-Increase in venous pressure (hydrostatic pressure) e.g.:

1- Heart failure. ✓

زيادة الضغط الهيدروستاتيكي

2- Venous obstruction in lower limb. ✓

DVT

3- Lymphatic obstruction due to pressure by tumour or parasite obstruction---increase inflow from capillaries-----odema ✓

(Elephantiasis).



Failure

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Failure

نقص البروتين في البول



Failure

زيادة الضغط في الأوعية الدموية (في الأوردة)

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Types of odema fluid:

1- Exudate (high in protein).

2- Transudate (low in protein).

→ It may be hemorrhagic.

• 1

نقص صناعى البروتين

Types of Oedema cont.

1-Transudate:

It contains less than 3 gm/dl. of protein,
it is usually clear or faintly yellow watery fluid,
it is caused by:

- a) Cardiac failure.
- b) Nephrotic syndrome.
- c) Anaemia.
- d) Constrictive Pericarditis.

2-Exudate:

It contains more than 3 gm/dl. of protein, it is cloudy fluid or pus
which clots on standing, it is caused by:

- a) Pulmonary tuberculosis.
- b) Bacterial pneumonia.
infarction.
- c) Carcinoma of lung.
Pancreatitis.
- d) Metastasis.
- e) Pulmonary
infarction.
- f) Acute
pancreatitis.

في الغلابة 8

Shock

Definition: a condition in which the vital functions of the body are depressed due to sever decrease in cardiac output and blood volume.

Character of shock:

- ✓ -Cardiovascular collapse---hypotension& tachycardia. $\downarrow COP, \downarrow BV$ $\downarrow BP, \uparrow HR$
- ✓ -Hyperventilation---hypoxia. $\uparrow RR$
- ✓ -Oliguria (decrease in urine volume).
- ✓ -Decrease cardiac output. $\downarrow COP$

Types of shock:

A-Hypovolemic shock (decrease in blood volume) e.g.;

- Trauma (sever hemorrhage, sever injury as in fracture & and burn) due to loss of fluid from large surface area.
- Dehydration (sever vomiting or sever diarrhea).
- Burns.

- Hemorrhage
- dehydration
- burns

Shock cont.

B-Cardiogenic shock caused by acute heart failure--- مشكل حاد في القلب
Hypovolemic and bacteremic HF is a complication.

C-Bacterial shock (end toxin)---septic

Causes:

- 1-Bacteria (gram -ve), staph and meningococci.
- 2-Associated conditions as septicemia, peritonitis.

Mechanism:

Bacteria---toxins---inflammation---release of chemical mediators
as cytokines---vascular damage + vasodilation---shock.

D-Anaphylactic shock:

A sever immune hypersensitivity reaction via antigen antibody
reaction.

مسار حساسية شديدة جداً

Hyperemia and congestion

Definition: abnormal accumulation of blood in vascular bed either due to:-increase in arterial inflow---hyperemia or -decrease in venous outflow---congestion.

تراكم الدم في الأوعية الدموية
↑ arterial inflow (hyperemia)
↓ venous outflow (congestion)

- زيادة الدم عند طرف الأوعية الدموية
- انسداد / مشكلة في مرور الدم عبر الأوعية

Haemorrhage

Definition: A state of effective loss of circulating blood.

Types: a) External haemorrhage. b) Internal haemorrhage.

انقباض / توسع / انقباض في الأوردة
ارتفاع ضغط في جدران الأوردة
كل نوع الأوردة بدمية الأوردة

Internal hemorrhage:

E.G.:

1- Traumatic rupture of internal organ.

2- Accidental trauma to major vessels

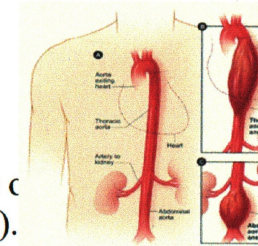
as aorta.

3- Local causes as in:

a) Rupture aortic aneurysm

b) Sever hypertension---rupture c

c) Malignant invasion (tumours).



Its signs:-

haemoptysis, haematemesis or melena.

May be

كحة + دم
قيء + دم
براز مع دم

Definitions:

Haemoptysis: coughing of blood.

Haematemesis: vomiting of blood.

Melena: blood in stool.

General signs of haemorrhage----- (Hypovolemic shock):

- ✓ a) Decrease in blood volume.
- ✓ b) Coldness.
- ✓ c) High pulse rate. \uparrow HR
- ✓ d) Pallor (anaemia).

\downarrow BV
 \downarrow BP

Shock ← شوك

Summary

➤ Inflammation is the dynamic process by which living tissues react to injury .Types (acute,subacute&chronic)

Classical signs(Pain,redness,hotness,swelling and loss of function.

- Ischemia is defined as reduced blood supply caused by embolism,thrombosis (Detached thrombus)
- Haemorrhage is either internal or external
- Edema is excess extracellular fluid (Transudate or exudate)
- Shock is defined as depressed vital function of the tissue .Types(Hypovolemic,cardiac,septic &Hypersensitivity)