Pathology

Subject :

Lec no : lec-20+21_

Done By : Hala AL Beshtawe

تدقيق وتعديل

وَقُل رَّبِّ زِدْنِي عِلْمًا

منتشر

Disseminated Intravascular Coagulation (DIC)

* معناها بإختصار انه عندي تخثر منتشر بكل الvessel

* الي بصير هون انه بكون عندي thombus بأكثر من مكان بالجسم

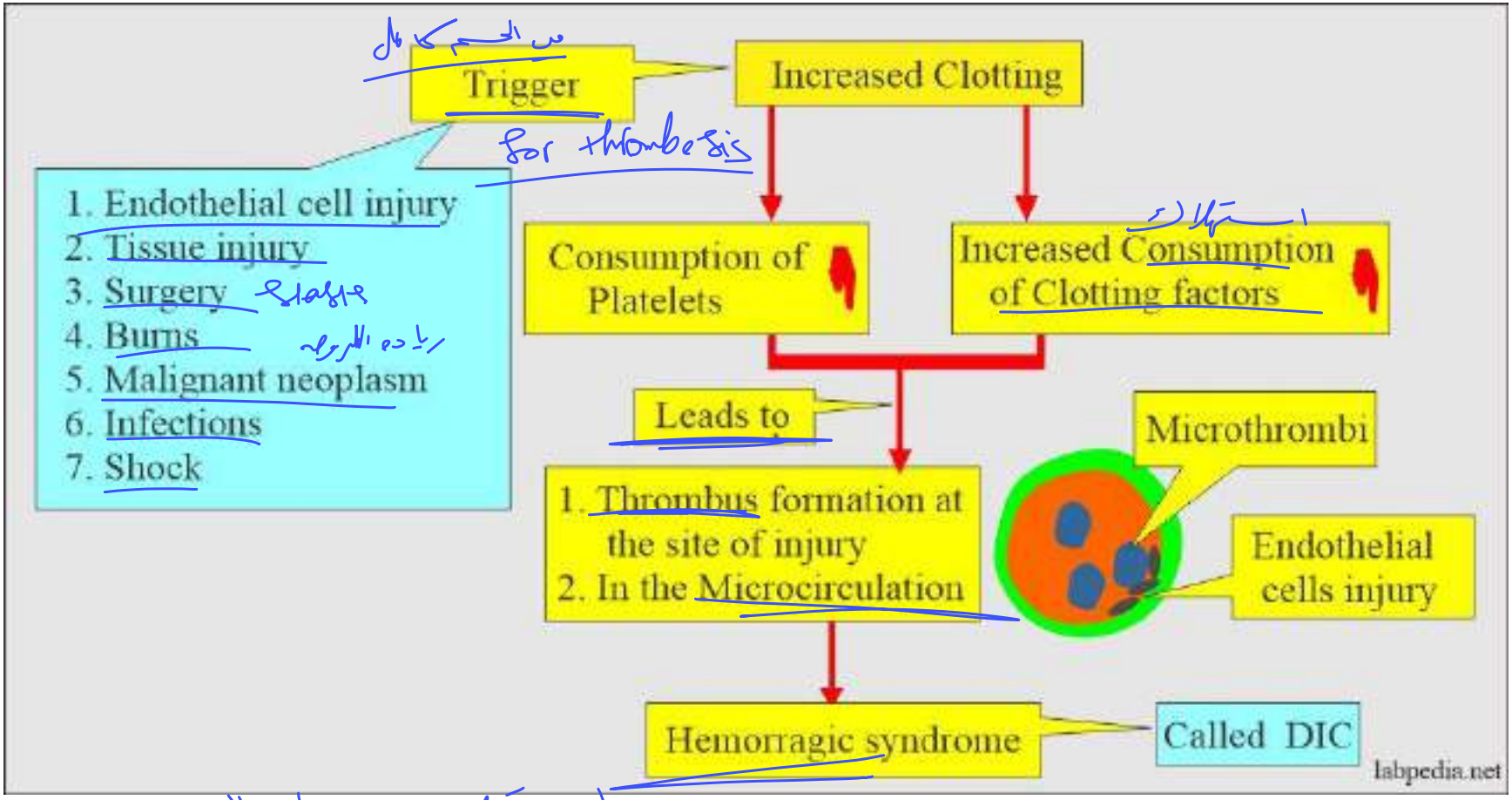
* المخطط الي تحت بحكيلك كالآتي :

راح يصير عندي triggers (يعني مسبب بغض النظر شو هو (هي أمثلة بالبوكس الأزرق)) راح يعملي wide spread EC injury يعني راح يعملي injury بأماكن مختلفة بالجسم تمام فأنه هاد الاشي راح يؤدي الى تحفيز للcoagulation الي بيعملي clotting فبزيد الclotting طيب لما يصير clotting ايش حيأثر ؟ التأثير انه حيزيد الclotting بزيادة + انه عوامل التخثر حيصير الها استهلاك كبير ، نرجع نأكد انه الinjury بأكثر من مكان لهيك برضه الthrombosis هون بأكثر من مكان

طيب حكينا انه صار استهلاك كبير لعوامل التخثر + platelets نفسها الي بتعملي تخثر هاد الاستهلاك الكبير راح يعملي bleeding مع الوقت فبصير عندي syndrom اسمها hemorragic syndrom

Disseminated Intravascular Coagulation (DIC)

pathophysiology



في البداية تخثرات بعدها نزيف

DIC is a thrombo-hemorrhagic disorder, characterized by systemic activation of the coagulation cascade by various stimuli , with hundreds of thrombi occluding microcirculation leading to hypoxia and microinfarcts

بال triggers يلي
wide عملت
spreed EC
injury

في مناطق صغيرة

١ ٢

It is also called consumptive coagulopathy , followed by bleeding due to consumption of platelets & clotting factors in blood

Mechanism of DIC;

-Very strong triggers -

1. **Wide-spread endothelial cell damage**
2. **The release of tissue factor or thromboplastic substances into the circulation**

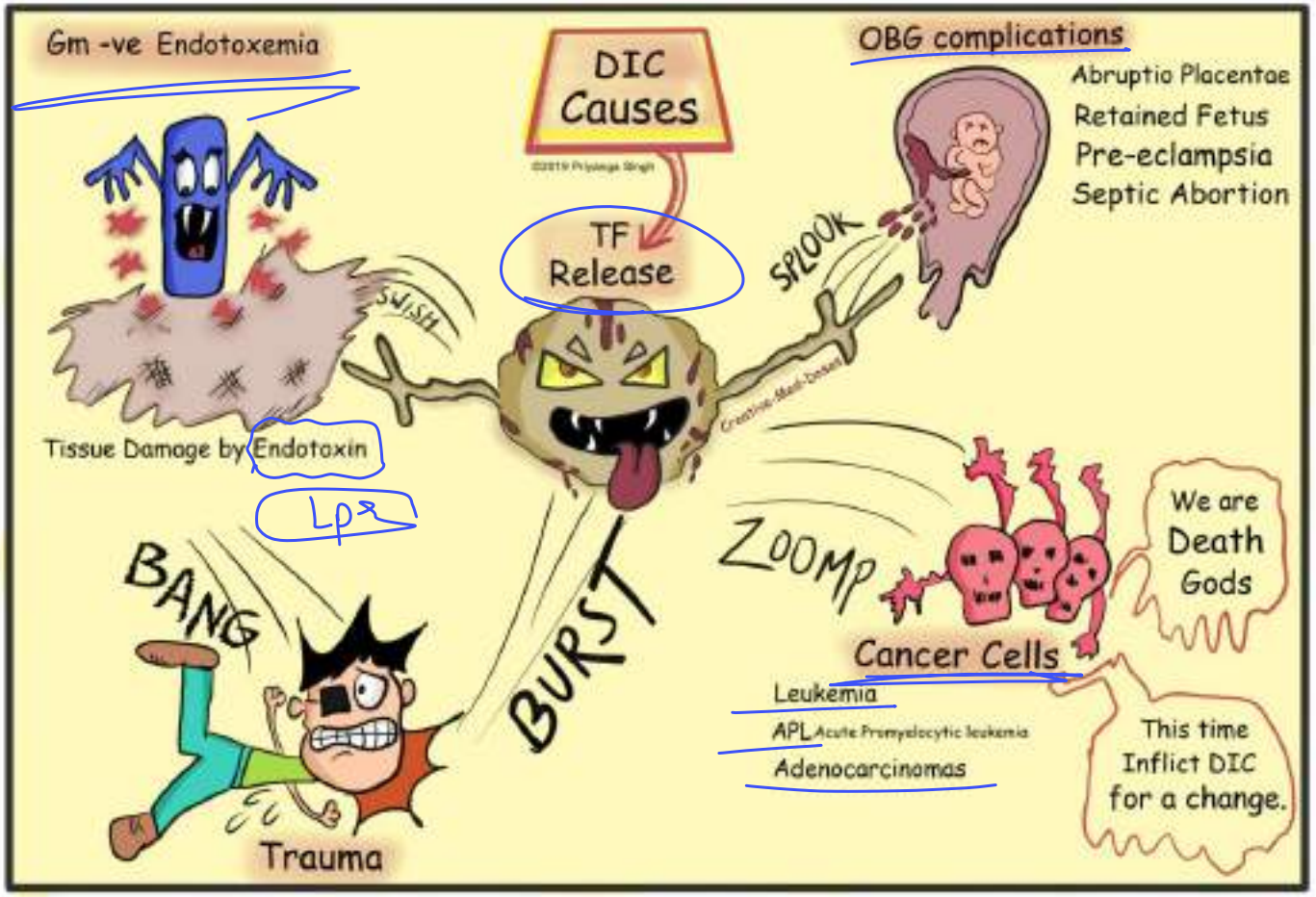
Extrinsic coagulation pathway

- ✓ It is characterized by a sudden or gradual onset of widespread fibrin thrombi in the microcirculation.
- ✓ DIC is not a primary disease but rather is a potential complication of any condition associated with widespread activation of thrombin
- ✓ The major causes of which including obstetric complications, infections , neoplasms , massive tissue injury & others .
- ✓ The thrombi can cause widespread & diffuse circulatory insufficiency , especially in the brain, lungs, heart, & kidneys.

• مثلًا اثناء الولادة لما يصير زيادة نزيف في الجسم بتتحول للICU ليه صار نزيف لانه صار عندي بدايةً DIC وهاد الthrombi multiple ممكن تسكر كثير organ vessels وتدخلنا بmultiorgan failure

ischemia then infaraion

Disseminated Intravascular Coagulation (DIC)



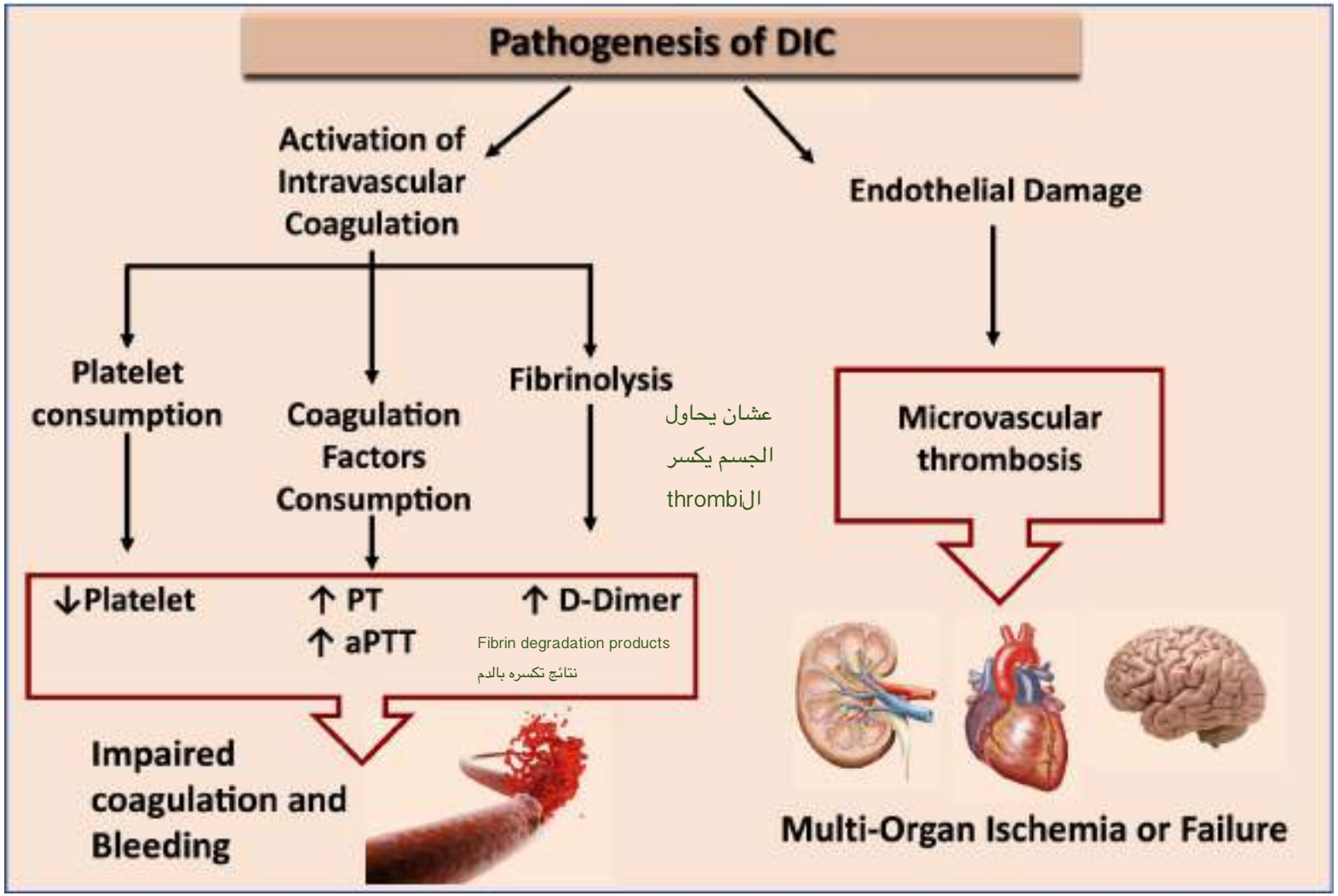
Manifestation of DIC

small vessels بتسكر

- **In kidneys**, microthrombi can result in numerous microinfarcts in renal cortex leading to bilateral renal cortical necrosis , then renal failure

- **In brain**, microthrombi & numerous micro infarcts in the brain --comaممكن يدخل ب--- lacunar infarcts
- **Lungs and GIT** involvement by microinfarcts
- **The adrenals** involvement leading to extensive bilateral adrenal hemorrhage called (Waterhouse Friedrichsen Syndrome)
- **In the skin** widespread petechiae, and ecchymosis

Disseminated Intravascular Coagulation (DIC)



Laboratory tests reveal:

- **Thrombocytopenia** → deficiency of platelets in blood → platelet consumption
- **Prolonged prothrombin time (PT) & partial thromboplastin time (PTT)**
- **Increase Fibrin degradation products (FDPs)**

Intrinsic

Extrinsic

Treatment: heparin & fresh frozen plasma, and treat the underlying cause

anti-coagulant

rich in plateletes

thrombocytopnia حتى ما يصير

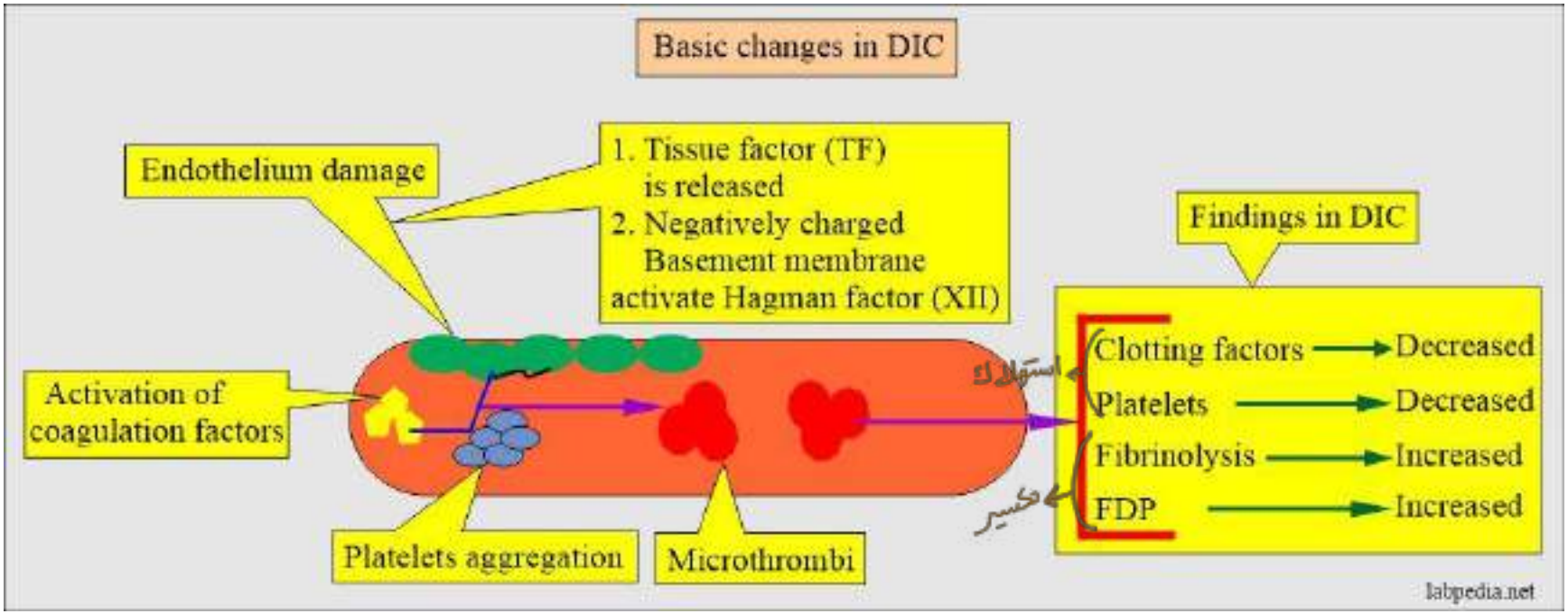


Figure 42 : Gross appearance of kidney showing renal cortical necrosis in DIC .

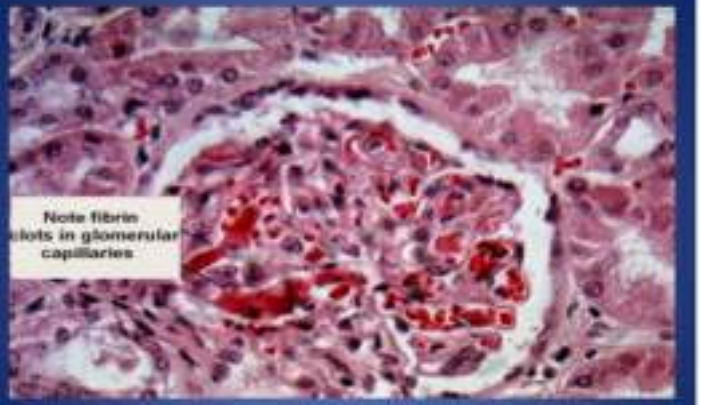


Figure 43 : DIC in kidney : Microscopic view .

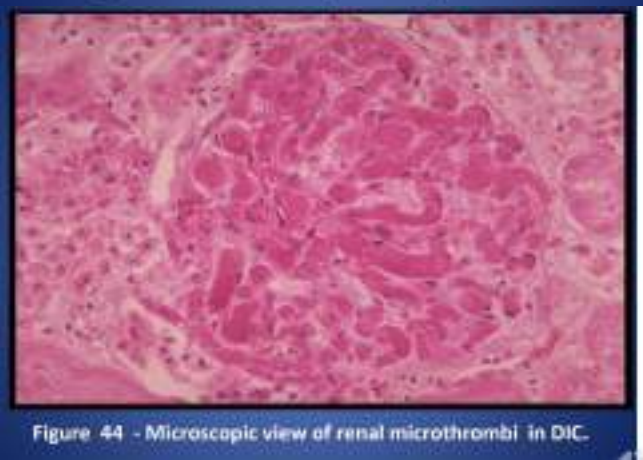


Figure 44 - Microscopic view of renal microthrombi in DIC.

Figure 45 : Gross appearance of lung showing features of DIC , numerous hemorrhagic microinfarcts & hemorrhages .

Figure 46 : Skin in DIC,

Embolism

اي اشي ممكن يتحرك بالجسم
مش شرط يكون بس thrombus

- An embolus is a detached intravascular **solid, liquid, or gaseous** mass that is carried by the blood to a site distant from its point of origin.
- 99% of all emboli represent some part of a dislodged thrombus, hence the term **thromboembolism.**

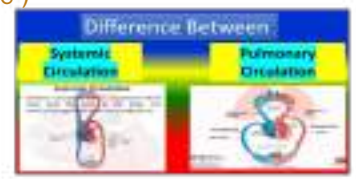
(BV) circulation System

Two forms:

1. **Pulmonary thromboembolism** leads to hypoxia and right-sided heart failure. DVT (deep vein thrombosis)
2. **Systemic thromboembolism:** Ischemic necrosis (infarction) of downstream tissue.

reminder

Thrombi جاي على شكل:
- Aorta
- Left side of heart (ventricle)



- Rare forms:

Air embolism, fat embolism, amniotic fluid embolism.

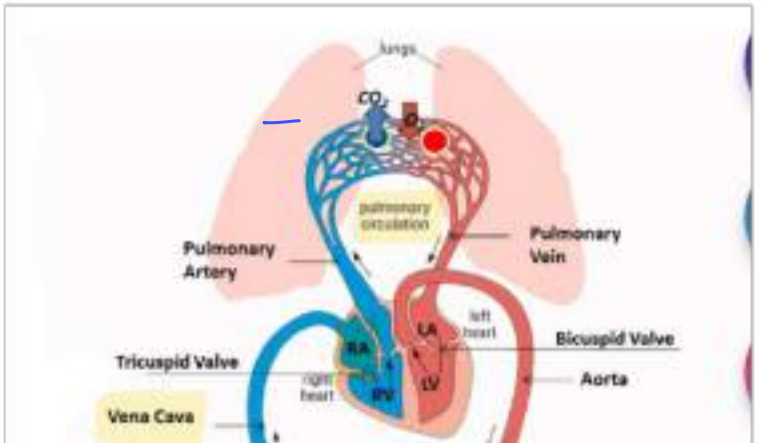
Pulmonary Thromboembolism

- In 95% of cases, emboli originate from thrombi within deep leg veins, above the knee (DVT).

ممكن يكون silent بحيث انه فش عندي symptoms بس المريض كان immobalized لفترة طويلة وبلش يظهر عنده اعراض بالchest فبتكون هون DVT كاملة pulmonary embolism

- They are carried through progressively larger channels and pass through the right side of the heart to the pulmonary vasculature.

IVC



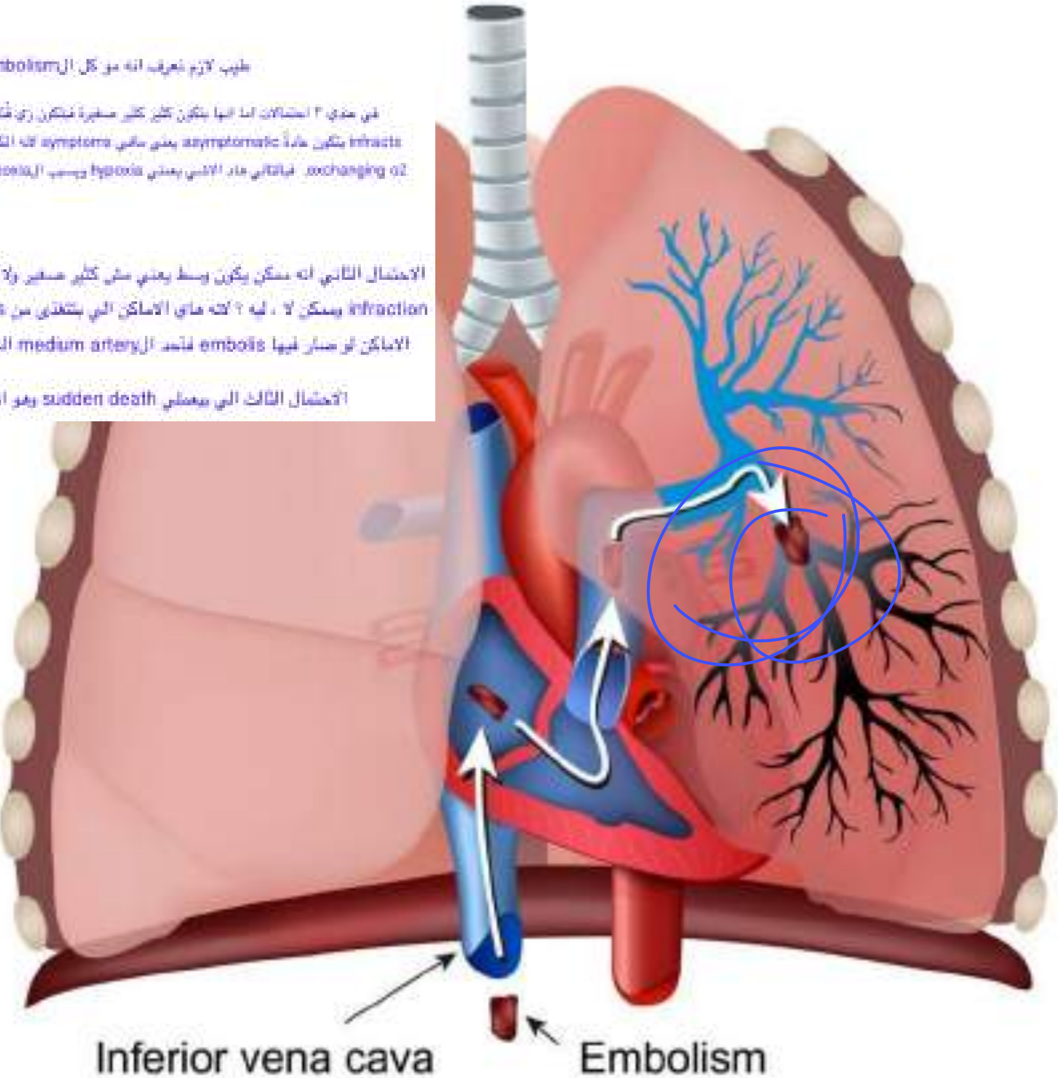
Pulmonary Embolism

طيب لازم نعرف انه مو كل الembolism بنفس الsize بيعتمد على حالة كل مريض

في عندي ٣ احتمالات اما انها بتكون كثير كثير صغيرة فبتكون زي فتات وبتدخل جوا الarterioles فبتعملي small infracts تخيلي هدا ماي الsmall infracts بتكون عادةً asymptomatic يعني مافي symptoms لانه المكان يكون صغير بس هاد الاشي راح يقلل من ال surface area الي بدي اياها for exchanging o2 . فبالتالي هاد الاشي يعني hypoxia ويسبب الhypoxia كاستجابة تعويض راح يصير في عندي vasoconstriction فبالتالي راح يزيد الpressure عن الright side of the heart وراح يصيرلها failure

الاحتمال الثاني انه ممكن يكون وسط يعني مش كثير صغير ولا كبير بتعرق من medium arteries الفكرة هون انه ممكن يصير infraction ويمكن لا ، ليه ؟ لانه هاي الاماكن الي بتتغذى من medium arteries ممكن تكون بتتغذى من فوق ومن تحت فهاي الاماكن لو صار فيها emboils فلما الmedium artery الي بتغذيها مش حيأثر لانه بتكون already مش معتمده عليها بس

الاحتمال الثالث الي بيعملي sudden death وهو انه الemboils بتكون كثير كبيرة وبتسكر الpulmonary trunk كله



clinical features of pulmonary thromboembolism:

depends on ① size of embolism ② which part of Palmonary Circulation

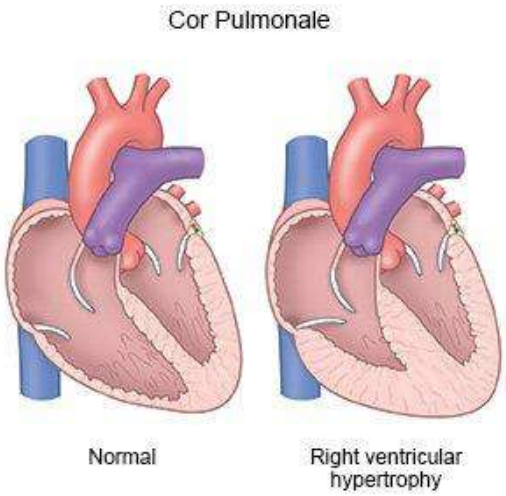
a. **Clinically silent:** 60% to 80% of emboli esp. small emboli.

b. **Sudden death or right sided heart failure** (acute cor pulmonale):A large embolus that blocks a major pulmonary artery or pulmonary trunk (**saddle embolus**)

c. **Pulmonary hemorrhage:** embolic obstruction of **medium-sized** arteries and subsequent rupture of capillaries, with no infarction since the area also receives blood through bronchial arteries.

d. Embolic obstruction of **small end arteriolar** pulmonary branches → infarction

e. **Pulmonary hypertension and chronic right ventricular failure (chronic cor pulmonale):** Multiple emboli occurring over time.



لانه بتضخ على pressure عالي

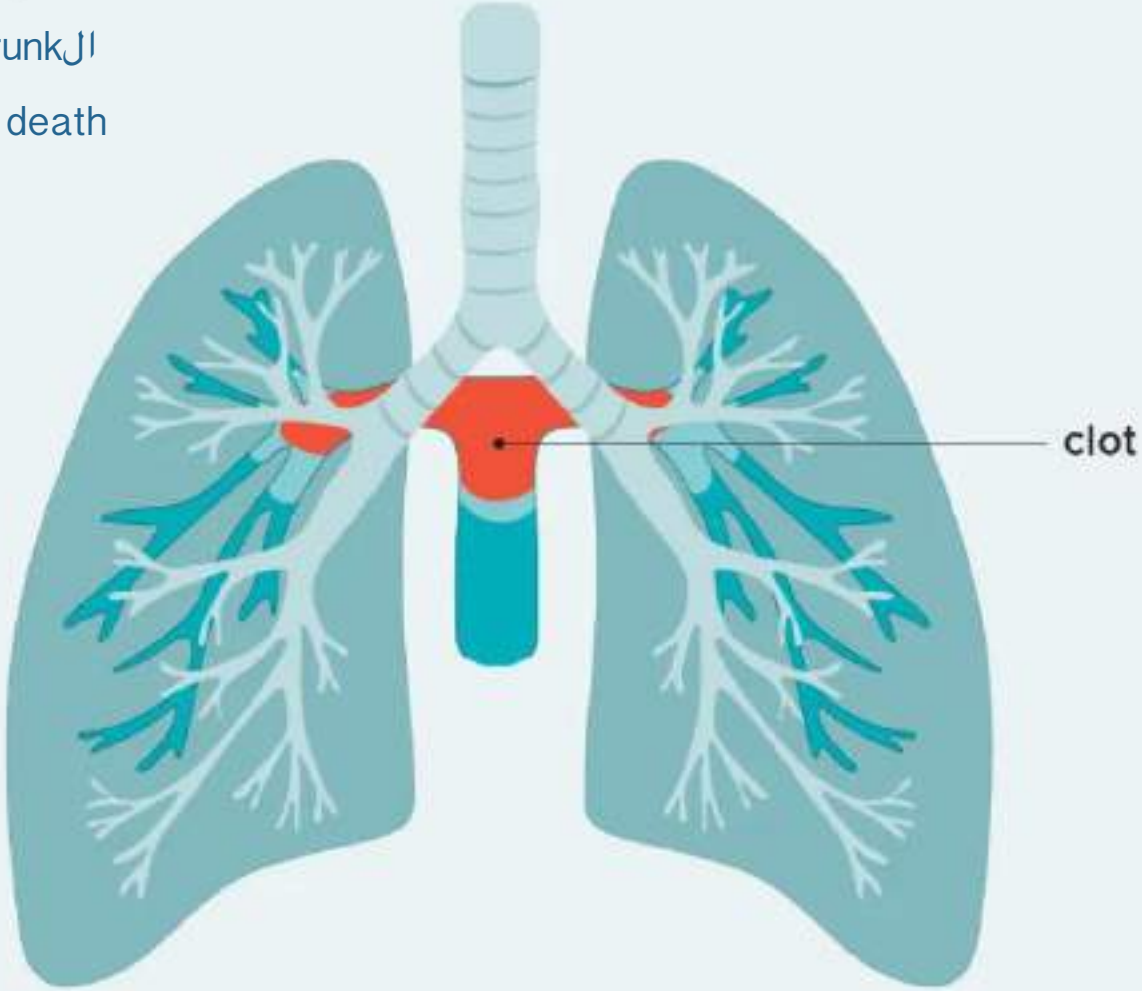
Saddle Pulmonary Embolism

بتكون كبيرة بتصير على

فبتعملك pulmonary trunkال

acuteل يؤدي sudden death

cor pulmonre

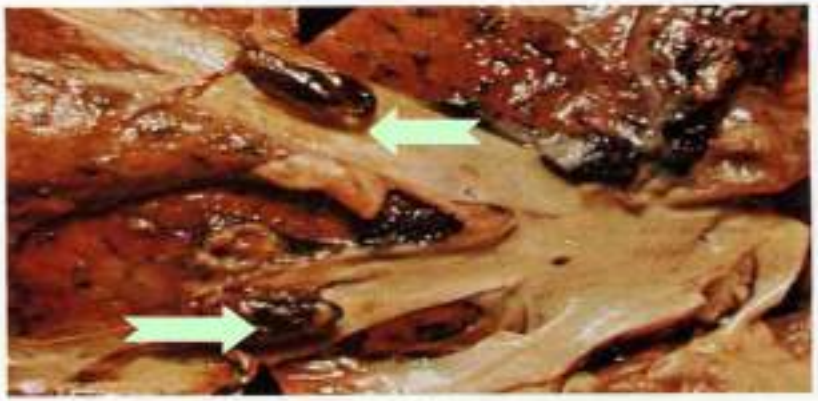


healthline

6.31 Pulmonary embolism

F 47 : Fatal pulmonary thrombo-embolism (PTE).
A large coiled-up thrombo-embolus . It lies within the Rt.V. outflow tract, filling the pulmonary trunk & the bifurcation of both Rt & Lt pulmonary arteries **(saddle embolus).**

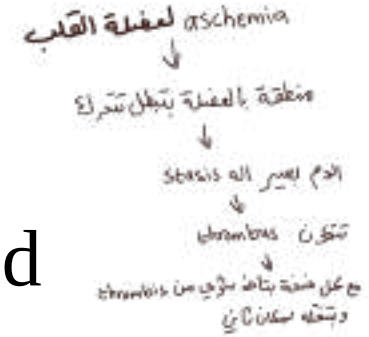
F 49 : Recurrent pulmonary Thromboembolism (PTE).
The secondary branches of a pulmonary artery have been opened to reveal two small emboli wedged within the vessels.
Both have tapering distal extensions.



6.34 Recurrent pulmonary embolism

F 48 : **Pulmonary Thrombo Embolism**: Saddle embolus

Systemic Thromboembolism



- 80% arise from **intra cardiac thrombi.**
- The remainder originate from **aortic aneurysms** and thrombi overlying ulcerated atherosclerotic plaques.

Common arteriolar embolization sites :

a. The lower extremities (75%).

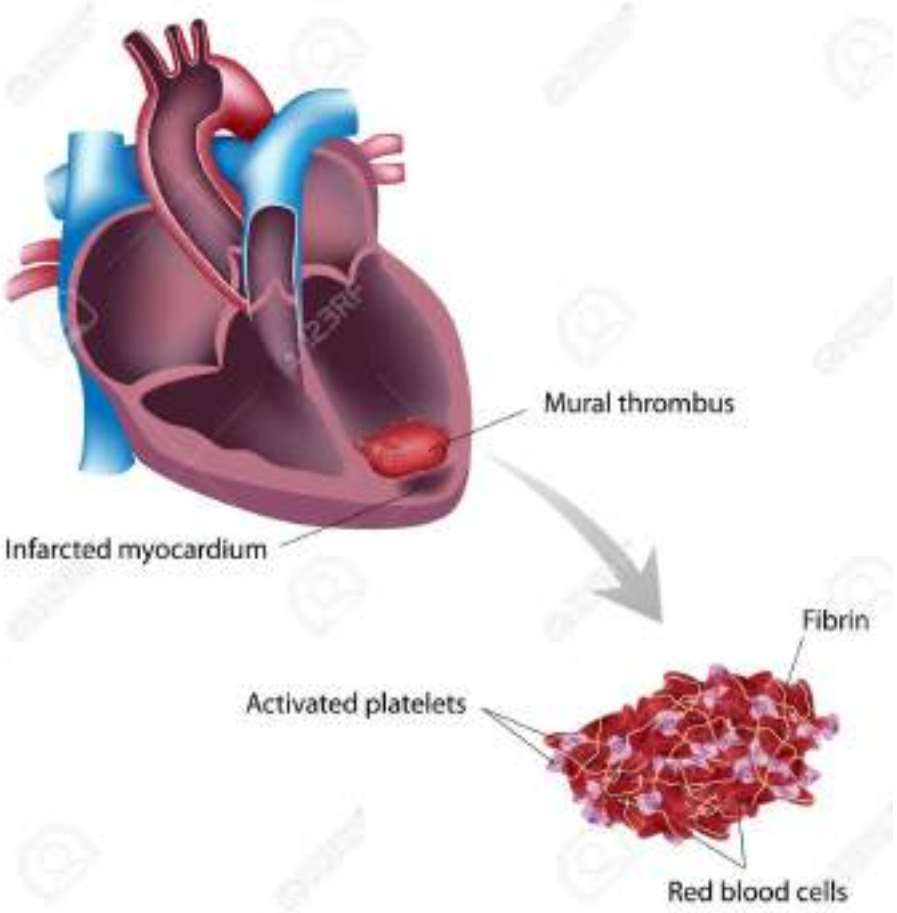
b. Central nervous system (10%).

c. Intestines and kidneys.

Note: Arterial emboli often cause infarction

لانه بقطع الblood supply of organ

Systemic Thromboembolism



history : الأسئلة
of car accidants
& fraction &
symptoms of
embolism

Fat Embolism

bone marrow

Caused by:

- Soft tissue crush injury or long bone fractures, with release of microscopic fat globules into the circulation.
- Fat embolism occurs in some 90% of individuals with severe skeletal injuries, but less than 10% show any clinical findings.

Fat embolism syndrome:

نفس سريع snortness of breath

a. Pulmonary insufficiency (tachypnea, dyspnea)

b. Neurologic symptoms (irritability and restlessness to coma)

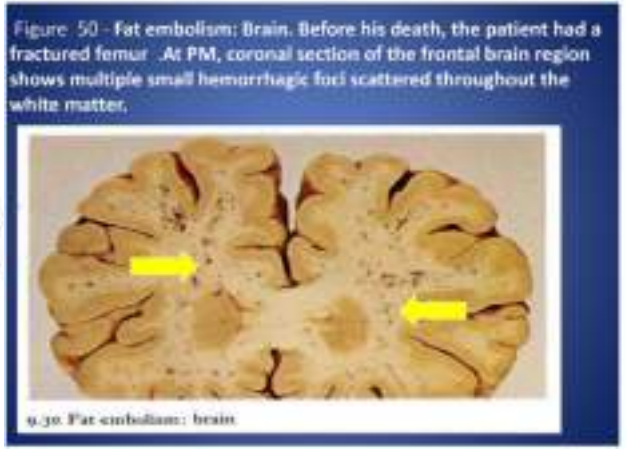
c. Anemia, thrombocytopenia. hemolysis ويعمل RBC& platelets يرتبط مع fatال

d. Diffuse petechial rash

72 hours

Typically, the symptoms appear 1 to 3 days after injury with sudden onset of symptoms

Fat Embolism



Pathogenesis: السبب

- Mechanical theory:

➢ Mechanical obstruction by microemboli of neutral fat +platelet &RBC aggregates

زي الthrombus
بس mainly مكون
من fat

- Intravascular coagulation theory:

➢ Chemical irritation (local injury to endothelium) from release of fatty acids + platelet activation & recruitment of granulocyyes –release of free radicals,protease &ecosanoids →DIC

Amniotic Fluid Embolism

السائل المحيط بالجنين

بالعادة الcirculation للأم والجنين ما برتبطوا مع بعض

- Introduction of amniotic fluid and its contents to the **maternal circulation** via a tear in the placental membranes and rupture of uterine veins during childbirth

*الي بصير انه يدخل الamneotic على الcirculation تبع الأم وبالنسبة لجسم الأم هاد اشي غريب فراح يصير anphylactic shack

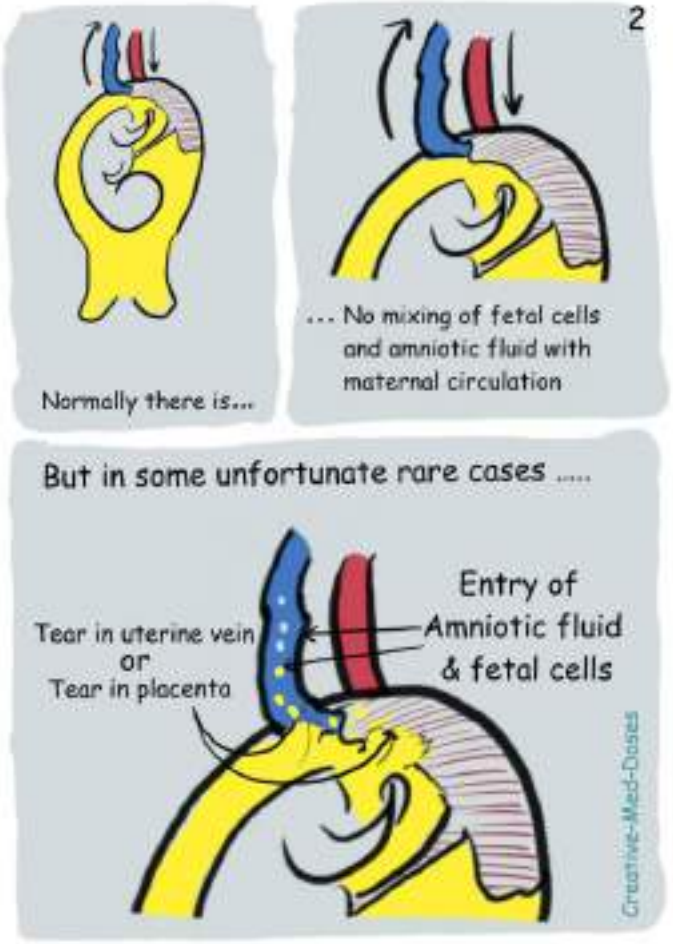
- Rare (1 in 40,000 deliveries), but carries 80% mortality rate

- **Manifestations:** Respiratory failure (sudden severe dyspnea, cyanosis, and hypotensive shock), seizures, and coma

Elements of baby's amneotic fluid

- **Histologic analysis:** squamous cells shed from fetal skin, lanugo hair, and mucin derived from the fetal respiratory or gastrointestinal tracts present in the maternal pulmonary microcirculation

شعر الزغب (الوبر)



Amniotic Fluid Embolism

INFARCTION

- Infarct: area of **ischemic necrosis** caused by **occlusion of vascular supply in a particular tissue**.
- **Arterial thrombosis or arterial embolism underlies the vast majority of infarctions.**
- **Venous thrombosis** can cause infarction, but it more often induces venous **obstruction and congestion**. blood & edema تجمع

- Infarcts caused by venous thrombosis thus usually occur only in organs with a single efferent vein (e.g., testis or ovary).

Venous thrombosis ... infarction قد يحدث

INFARCTION

- Infarcts are classified on the basis of their **color** (reflecting the amount of hemorrhage) and the presence or absence of microbial infection:

- **Red (hemorrhagic)**
- **White (anemic)**
- **Septic.**

Red infarcts

(1) **With venous occlusions** (such as in ovarian torsion).

التواء

hemorragic فيصير infraction عندي مع انه arterial supply عندي لسا

(2) In **loose** tissues (such as lung).

(3) In tissues with **dual** circulations such as lung and small intestine.

lung + small intestine + liver

= collection of blood

(4) In tissues that were previously congested because of sluggish venous outflow.

(5) When flow is **re-established** to a site of previous arterial occlusion.

فيالحالة الطبيعية انا
عندي أكثر من
artery بغذي هاي المنطقة
لو وقف سير الدم بواحد
منهم الثاني بغذي المكان
بس بس الي بصير انه
التسكير لال emboli
بكون sudden ما بلحق
الثاني يغذي المنطقة
فبصير hemorragic
infraction

* اللون ببين red لانه بكون coronary artreies مسكرة فبالتالي انا راح احط شبكيه بمنطقة infracted

لانه الcoronary arteries مسكرة فما حيوصل blood supply فحيكون عنا aschemia فانا راح احط

شبكيه في منطقة infracted اصلًا فبالتالي راح يوصل blood supply لمنطقة ميتة فراح يبين red

Red infarcts

twisted

ovary

one لانه

effecte

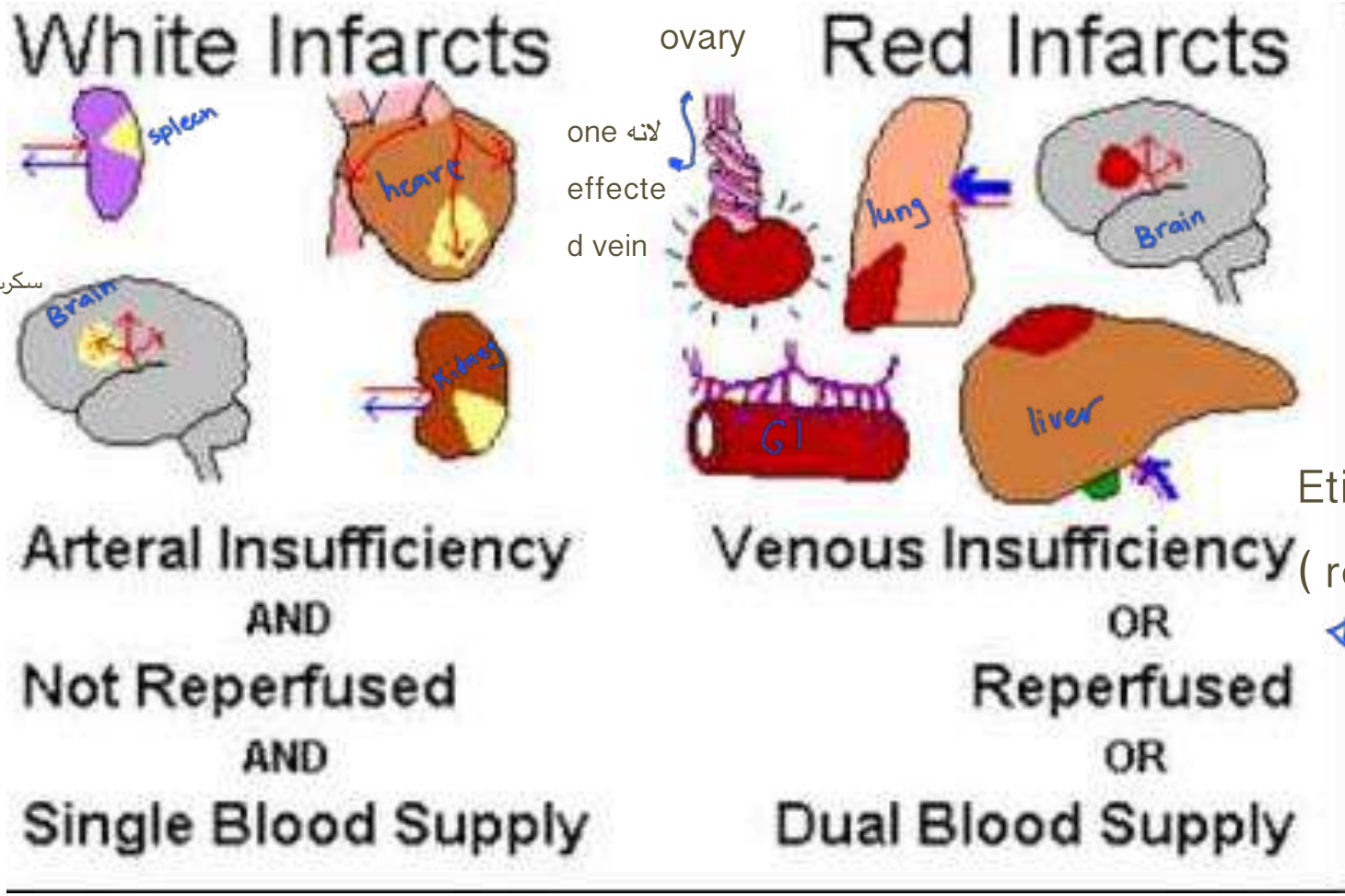
d vein

* عادة بتصير

بالsolid organs

* فيها end arteries لو

سكرت فش غيرها يغذي المنطقة



Etiology

(reasons)

7.38 Infarction: lung

Figure 54 -Lung infarction. There is lower lobe,sub-pleura, pale pink, wedge-shaped infarct.

The infarct is swollen, with raised pleural surface over it, & is surrounded by a dark-red congested border.

White infarcts

base V apex shaped

- Occur with **arterial occlusions** in **solid organs** with end-arterial circulations (e.g**., heart, spleen, and kidney)**

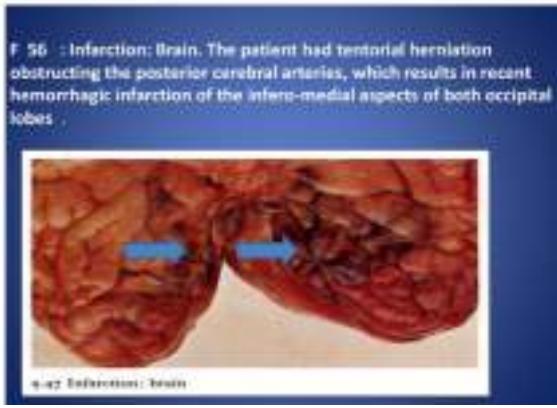
red inf → يحدث بسبب تمزق الأوعية الدموية

- Where the solidity of the tissue limits the amount of hemorrhage that can seep into the area of ischemic necrosis from the adjoining capillary beds

B, Sharply demarcated pale infarct in the spleen (white infarct).

Fig. 55 : A, Hemorrhagic wedge-shaped pulmonary (red infarct).

Infarction



- Infarcts tend to be wedge-shaped, with the occluded vessel at the apex and the organ periphery forming the base

- The main histological finding: **ischemic coagulative necrosis, except the brain, in which liquefactive necrosis occurs.**

Shock

blood supply for all organs

- Definition: Systemic hypoperfusion and reduced oxygen delivery due to either reduced cardiac output, or ineffective circulatory blood volume.

- Results of shock:
  - hypotension.
  - impaired tissue perfusion.
  - cellular hypoxia.

• طيب اولًا بدك تعرف انه الblood pressure يعتمد على

شغلتين :الresistance والcardiac output

•في حال قل الvasodilation الresistance راح يقل فبالتالي يقل الBP

• طيب عندك الcardiac output وهو العامل الثاني الي بيعتمد عليه الBP هاد بيعتمد على

حاجتين برضه الheart rate والvolme في حال قل اي منها بقل الcardiac output فبقل الBP

* في حال عندي (heart attack) MI العضلات راح تموت فبقل

الcntraction فبقل الvolume فبقل الcardiac output وبقل الBP

• There are tow mechanisms to increase BP :

sympathatic --> epiniphrine --> vasoconstriction

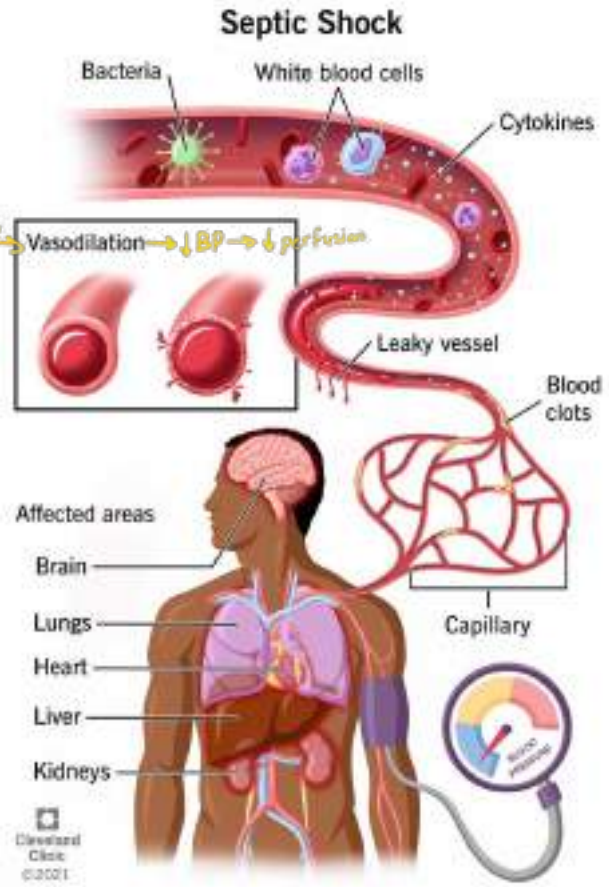
kidney --> renin --> *vasoconstriction
* Na & water retention

Major types of shock

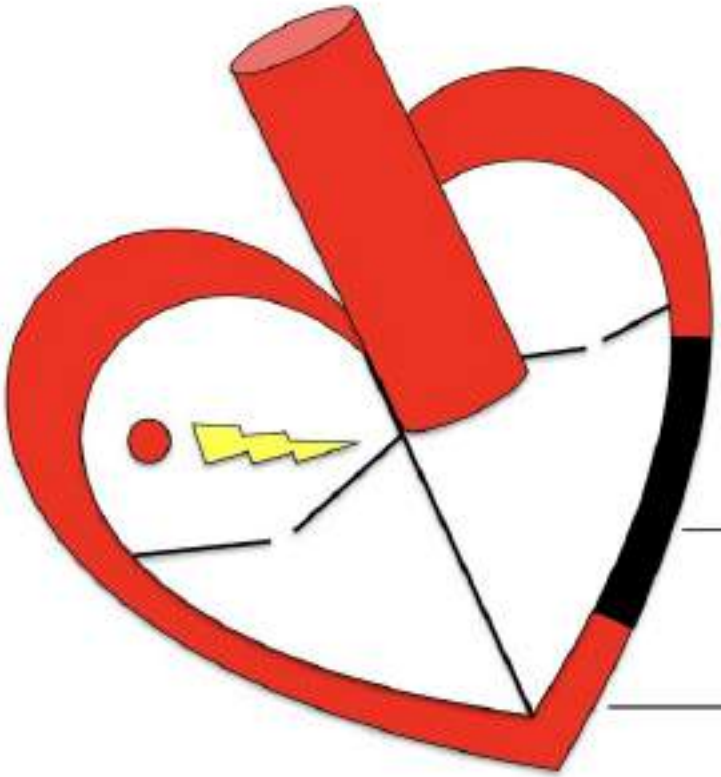
- **Cardiogenic shock:** results from low cardiac output due to myocardial pump failure.
- **Hypovolemic shock:** results from low cardiac output due to loss of blood or plasma volume (e.g., due to hemorrhage or fluid loss from severe burns).
- **Septic shock**
  Infections

Septic shock

- High mortality rate
- **Gram-positive bacteria** constitute the most common cause of septic shock, followed by gram-negative organisms and fungi.
- **Systemic arterial and venous dilation leads to tissue hypoperfusion**.

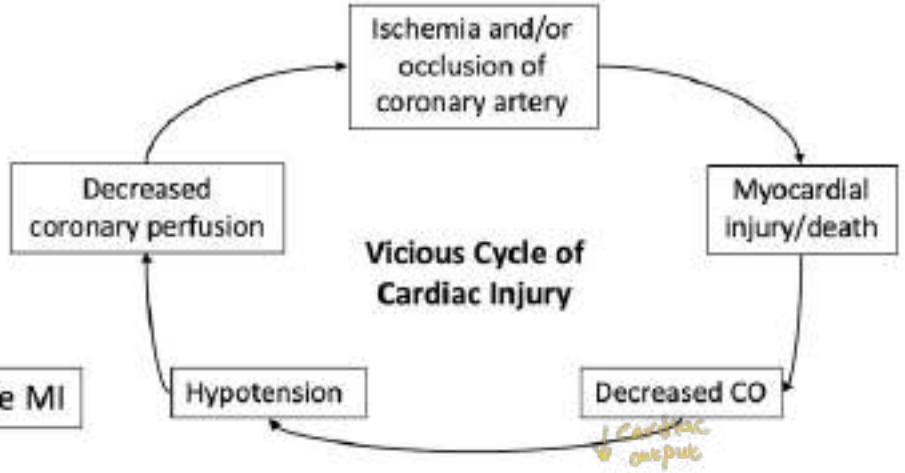


Cardiogenic Shock

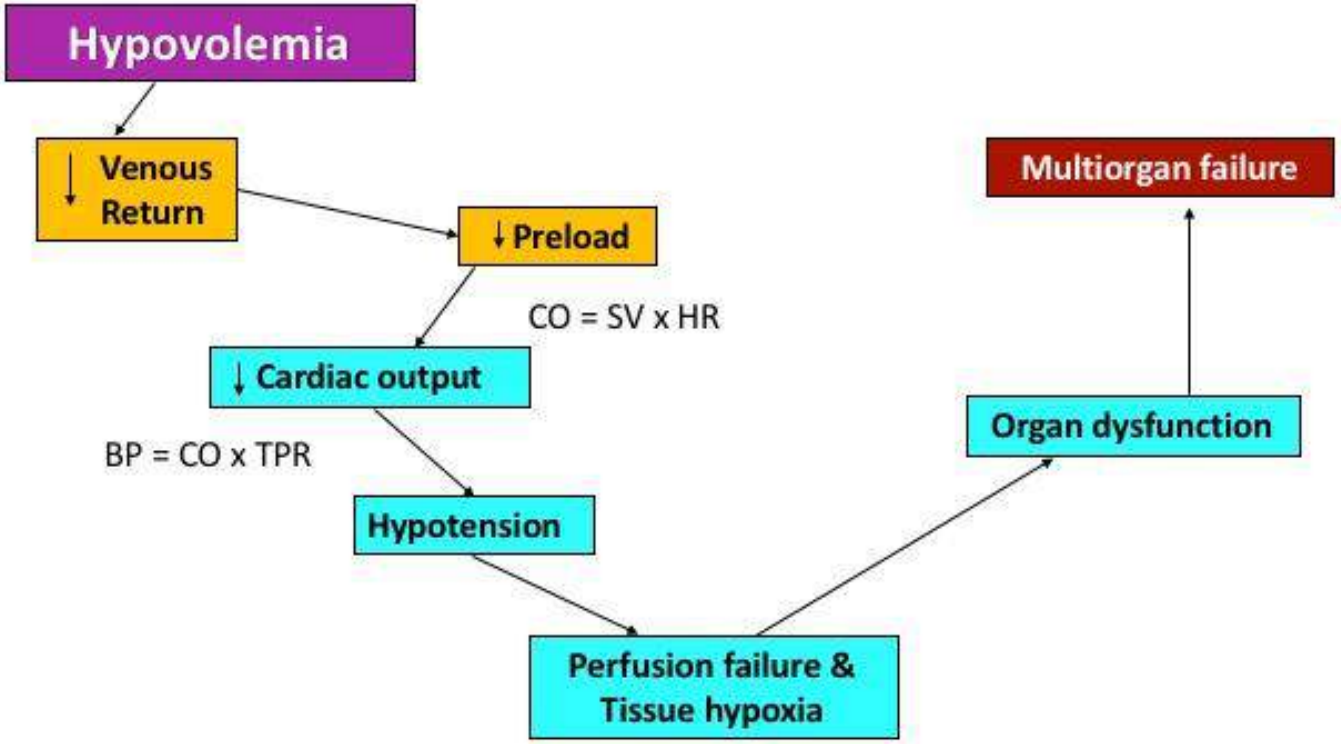


Acute MI

Acute Decompensated HF
Cardiomyopathy
Myocarditis



Pathophysiology of Hypovolemic shock



Stages of Shock

Shock is a progressive disorder that leads to death if the underlying problems are not corrected

- **Non-progressive phase: Compensatory mechanisms maintains perfusion of vital organs.** - Epinephrine -renin_ A
- **Progressive phase: Tissue hypoperfusion with metabolic and circulatory worsening.**
- **Irreversible stage: Severe irreversible tissue and cellular injury** that even if the hemodynamic defects are corrected, survival is not possible

- The clinical manifestations of shock depend on the precipitating insult.
- **In hypovolemic and cardiogenic shock:** hypotension, a weak rapid pulse, tachypnea, and cool, cyanotic skin.
- **In septic shock:** the skin may be warm and flushed owing to peripheral vasodilation.
- Prognosis varies with the origin of shock and its duration.
- More than 90% of young, healthy patients with hypovolemic shock survive with appropriate management
- Septic or cardiogenic shock is associated with substantially worse outcomes

Periphries ما عم يوصلهم دم

high infection

death of muscle

ما بتعالج بأي antibiotic لانه بسببه أكثر من microorgani

Treatment

- Septic shock is treated with antibiotics and fluids.
- Anaphylactic shock is treated with diphenhydramine (Benadryl), epinephrine (an "Epi-pen"), and steroid medications (solumedrol).
- Cardiogenic shock is treated by identifying and treating the underlying cause.
- Hypovolemic shock is treated with fluids (saline) in minor cases, and blood transfusions in severe cases.
- Neurogenic shock is the most difficult to treat as spinal cord damage is often irreversible. Immobilization, anti-inflammatories such as steroids and surgery are the main treatments.
- Shock prevention includes learning ways to prevent heart disease, injuries, dehydration, and other causes of shock.