



محتف

the heart can't pump blood well enough to meet body needs.

Pathophysiology-Congestive Heart Failure

Faculty of Pharmaceutical Sciences

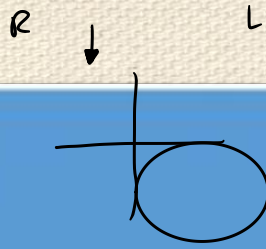
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□ Heart Failure

- The inability of the heart to maintain an output adequate to maintain the metabolic demands of the body.
- Heart failure may result from a primary abnormality of the heart muscle—for example, an infarction—that impairs ventricular function and prevents the heart from pumping enough blood. تضعف

□ What is HF

- Complex syndrome that can result from any structural or functional cardiac disorder that impairs the ability of the heart to function as a pump to support physiological circulation.
- Heart failure may also be caused by problems unrelated to MI:
 - ✓ Mechanical disturbances in ventricular filling during diastole, due to blood volume that's too low for the ventricle to pump.
 - myocardial infarction
 - relaxing filling
 - ✓ Systolic hemodynamic disturbances—such as excessive cardiac workload caused by volume overload or pressure overload—limit the heart's pumping ability.
 - contraction دورة القلب
 - contraction ↓



Type of heart failure	Description
Left-sided heart failure	The left ventricle of the heart <u>struggles to pump blood</u> , resulting in a <u>buildup of fluid in the pulmonary veins</u> , <u>causing shortness of breath</u> .
Right-sided heart failure	Right side of the heart <u>struggles to pump blood to the lungs</u> , resulting in fluid backup in the legs, feet, and abdomen. (<i>edema</i>) ↳ bring O ₂ from lungs → heart
<i>contraction</i> Systolic heart failure	The left ventricle cannot <u>contract completely</u> , meaning that the heart cannot pump with enough force to move blood throughout the body properly.
<i>relaxing / filling</i> Diastolic heart failure	The left ventricle cannot <u>relax</u> , not allowing it to fill completely, resulting in not enough blood being pumped to the rest of the body.

جانبیت صح وخطأ right-sided heart failiure ییرجع الدم للریئة،

الجواب خطأ

- Compensated phase

- Supply temporarily meets the altered demand, no or very mild symptoms and signs

- Decompensated heart failure:

- new or worsening symptoms/signs of dyspnoea, fatigue or oedema leading to hospitalisation or unscheduled medical care

ضيقاً
تنفساً
shortness of
breath

تجمع سوائل
swelling caused
by fluid accumulation

□ Compensated and Decompensated Heart Failure

مراجعة

□ Pathophysiology

- Main Causes of Heart Failure:

- Ischemic Heart Disease (35-40%)

- Cardiomyopathy (خلل في عضلات القلب) (dilated) (30-34%)

- Hypertension (15-20%)

- Other Causes:

- Valvular Heart Disease.

- Congenital Heart Disease.

- Alcohol and Drugs.

- Arrhythmias.

Causes of heart failure?

Arrhythmia

Hypertension

Ischemia

Cardiomyopathy

All of the above ✓

Question 28 / 40

Which of the following is a cause for heart failure?

1. Myocardial infarction
2. Tachycardia
3. Alcohol intake
4. Valvular disease
5. All the above

□ Pathophysiological Changes in HF

- Ventricular Dilatation.
- Myocyte Hypertrophy.
- Salt and Water Retention.
- Sympathetic Stimulation.
- Peripheral Vasoconstriction.

نربطهم

القلب لا يضخ كمية دم كافية $BV \downarrow \rightarrow BP \downarrow$
لذا تفعل SNC ليرفع الضغط

له تأثيره
vasodilation centrally
vasoconstriction peripherally

يدنا كل الماء إلى الجسم لرفع BV فنحصل water retention

Physical change in heart failure ventricular
vasoconstriction , salt and water retention
and peripheral vasodilation

وكان false

Symptoms:

ناتج عن حطر

• Exertional Dyspnea.

→ shortness of breath

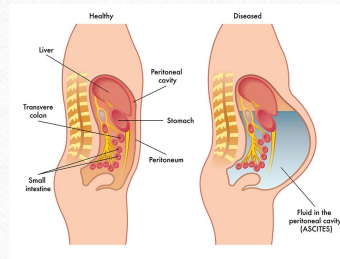
ضيق تنفس
عند الاستلقاء

• Orthopnea. shortness of breath that happens when you are lying on your back.

حجابي / نوبات

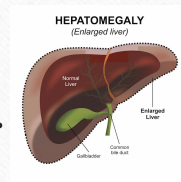
• Paroxysmal Nocturnal Dyspnea.

لبي



Signs:

- Cardiomegaly. تضخم القلب
- Elevated Jugular Venous Pressure.
- Tachycardia.
- Hypotension.
- Bi-basal crackles. sounds of the lungs
- Pleural effusion.
- Ankle Edema.
- Ascites.
- Tender hepatomegaly.



Question 30 / 40

Jugular vein is the blood vessel which transport blood to the brain. The elevation of blood pressure in this vein is a sign of heart failure.

True

False

Question 35 / 40

A 77 old male who has diabetes and hypertension, with history of ischemic heart disease, presented to the hospital suffering from dyspnoea, ascites and ankle oedema, his cardiologist asked for chest X-ray image to assess the heart muscle size. What do you expect the size of the heart would be in this case?

1. Left ventricular hypertrophy
2. Left ventricular hypotrophy
3. Heart size should be normal in this case
4. The cardiologist diagnosis approach was not correct
5. None of the above

one of the symptoms of HF is shortness of **صِحّ وخطأ**

breath during sleeping, **الجواب صِحّ**

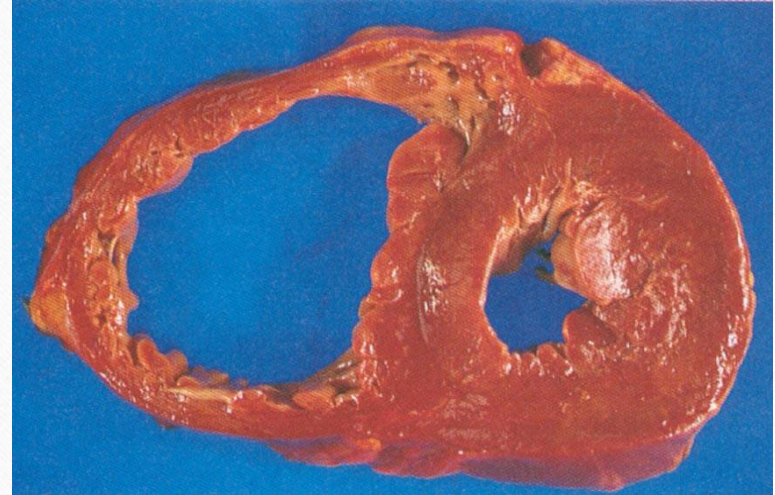
- **Edema**

الأطراف السفلية

- Bilateral lower extremity edema

- **Hypertension**

- Hypertrophic Cardiomyopathy



elevated jugular
venous pressure



□ Classification of HF:

- I. **No limitation**. Normal physical exercise doesn't cause fatigue, dyspnea or palpitations. خفقان
- II. **Mild limitation**. Comfortable at rest but normal physical activity produces fatigue, dyspnea or palpitations.
- III. **Marked limitation**. Comfortable at rest but gentle physical activity produces marked symptoms of HF.
- IV. **Symptoms of HF occur at rest** and are exacerbated by any physical activity. ^{تفاقم}

Point of maximum Impulse (PMI)

- The **apex beat**, also called the **point of maximum impulse (PMI)**, is the furthestmost point outwards (laterally) and downwards (inferiorly) from the **sternum** at which the **cardiac impulse** can be felt. The cardiac impulse is the result of **the heart rotating, moving forward**, and striking against the chest wall during **systole**. *contraction*
- The normal apex beat can be **palpated** in the **precordium left 5th intercostal space**, at the point of intersection with the **left midclavicular line**. In children the apex beat occurs in the **fourth rib interspace medial to the nipple**. The apex beat may also be found at abnormal locations; in many cases of **dextrocardia**, the apex beat may be felt on the right side. **Lateral and/or inferior displacement** of the apex beat usually indicates **enlargement of the heart**.

Question 39 / 40

The apex impulse can be felt in children at:

1. Third rib
2. fourth rib
3. Fifth rib
4. sixth rib
5. Second rib

❖ Compensatory Mechanisms

- ✓ Increased Heart Rate: $HR \uparrow$
 - Sympathetic = Norepinephrine

- ✓ Dilation:
 - Frank Starling = Contractility

- ✓ Neurohormonal:

• إعادة تقسيم Redistribution of Blood to the Brain

Question 7 / 40

In case of heart failure, one of the compensatory mechanisms is blood redistribution which means:

1. Redistribution of blood flow to be equal to whole body parts
2. Increase blood flow to the skeletal muscles
3. Redistribution of blood flow to be higher to brain
4. Redistribution of blood to increase blood infiltration to body tissues
5. B&C

بھیس لینا

congestive heart failure

CHF Vicious Cycle

- 1- myocyte hypertrophy
- 2- ventricular dilation
- 3- water / salt retention
- 4- SNS stimulation
- 5- peripheral vasoconstriction

start point

CO Low Output

BV ↓ → BP ↓

SNC activation

long term effect

Increased Preload Increased Afterload

↑ Norepinephrine

short term compensation

Increased Salt

Vasoconstriction

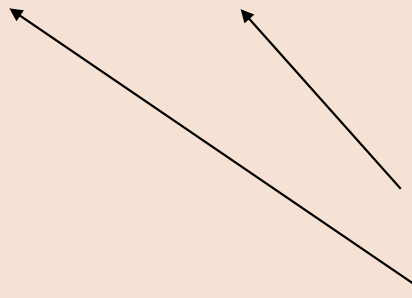
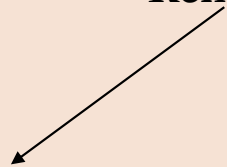
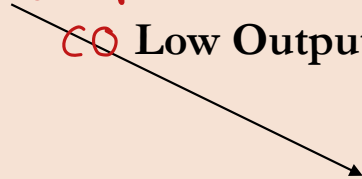
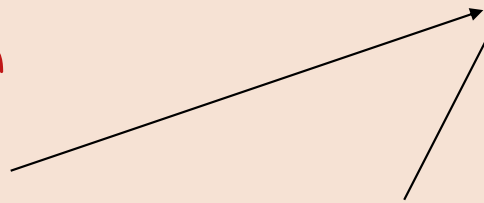
Renal Blood Flow

Renin

Angiotensin I

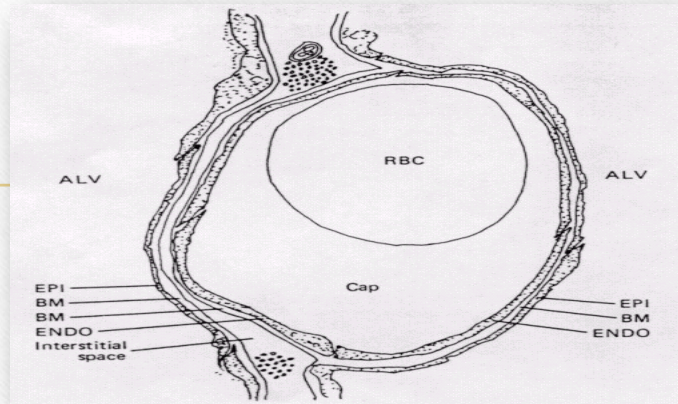
Angiotensin II

Aldosterone

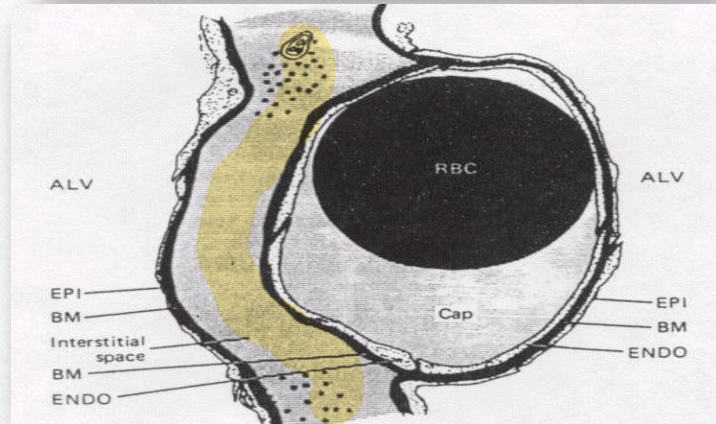


❖ Infiltration of Interstitial Space

➤ Normal
Micro-anatomy

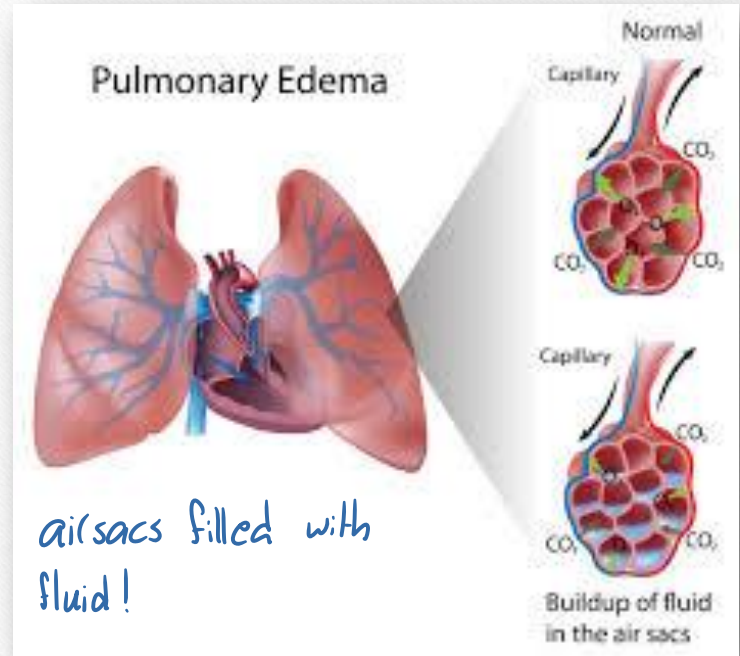
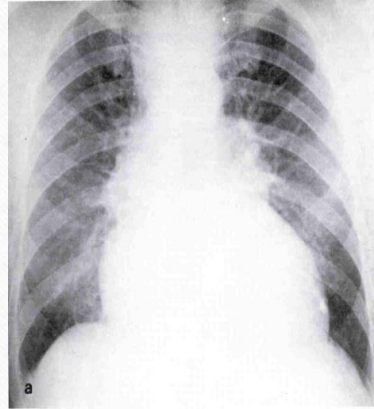
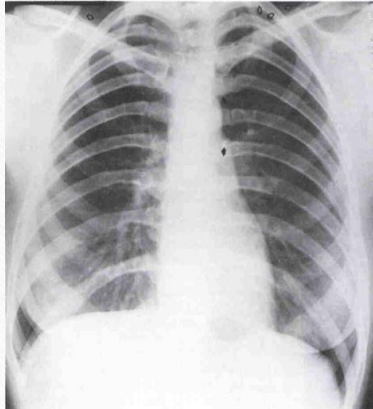


➤ Micro-anatomy
with fluid
movement.



Acute Pulmonary Edema

a true life-threatening emergency



Question 12 / 40

Which of the following is considered as a life-threatening emergency in case of heart failure?








1. Ascites
2. Hepatomegaly
3. Ankle oedema
4. Tachycardia
5. Pulmonary oedema

□ Treatment

- All**
- Prevention. **Control of risk factors**
 - **Lifestyle.**
 - **Treat etiologic cause / aggravating factors.**
 - **Drug therapy.**
 - **Personal care. Teamwork.**
- إلى تفاهم المرضي

- Selected patients**
- **Revascularization if ischemia causes HF.**
 - **ICD (Implantable Cardiac Defibrillator).**
 - **Ventricular resynchronization.**
 - **Ventricular assist devices.**
 - **Heart transplant.**
 - **Artificial heart.**
 - **Neoangiogenesis, Gene therapy**

Treatment Objectives*

-  **Survival**
-  **Morbidity** (*proportion of illness in a population*)
-  **Exercise capacity**
-  **Quality of life**
-  **Neurohormonal changes**
-  **Progression of CHF**
-  **Symptoms**

Treatment- Pharmacologic Therapy

- ✓ Diuretics
- ✓ ACE inhibitors (Angiotension converting enzyme inhibitor)
- ✓ Beta Blockers
- ✓ Digitalis اعتاب طبيه
- ✓ Spirolactone (Aldosterone Antagonist)
↓
Na⁺/water excretion
- ✓ Others