HEART FAILURE

(CHAPTER 26)

QUESTION 1

What is the underlying problem in heart failure?

Heart failure can occur for many reasons, but the core similarity is that there is some sort of problem with the normal **pumping action** of the heart.

Regardless of the underlying cause, heart failure always results in in a **decrease** in cardiac output, **reducing** oxygen supply to the body.

The word "**failure**" can be slightly misleading—the heart isn't completely non-functional, it just isn't working as **efficiently** as it should be.

This is a **chronic problem** that **millions** of people live with; it requires management, but not life-saving immediate intervention like a MI does.

QUESTION 2

Describe the symptoms of heart failure.

fatigue and **inability to exercise** – reduced aerobic metabolism due to low O_2 supply

dysypnea/SOB – sensation of not getting enough O_2 to the tissues

peripheral edema – "backing up" of blood into venous circulation

QUESTION 3

What mechanisms exist to compensate for heart failure?

The body can detect when there is a decrease in **cardiac output**.

Its response typically involves an **increase** in blood pressure (both systolic and diastolic.)

Fluid is **retained** by the kidneys, increasing the total blood **volume**

Blood vessels **contstrict**, also raising diastolic BP

The nervous system stimulates the heart to **pump harder** to overcome resistance

QUESTION 4

What is a consequence of compensation?

Unfortunately, in many cases, this compensation can actually make the situation worse.

For example, in congestive heart failure (CHF,) heart failure is caused by **excess fluid volume**.

When the body sees the decrease in CO and tries to compensate by increasing the BP, this only worsens the problem.

The fluid retention triggered by heart failure can lead to a situation referred to as **volume overload**, where there is too much blood in the heart for it to pump effectively.

Over time, the increased stimulation of the heart can lead to fatigue and hypertrophy of the heart muscle.

QUESTION 5

Compare the consequences of left and right heart failure.

In **both** LHF and RHF, the impaired pumping action causes a "**back-up**" of the blood leading **into** the affected side of the heart.

In **left** heart failure, this backup increases the blood pressure **in the lungs**, causing **pulmonary hypertension**.

In **right** heart failure, the blood backs up into the **systemic venous circulation**, causing **edema**.

QUESTION 6

Compare systolic (HFrEF) and diastolic (HFpEF) heart failure.

The concept of **ejection fraction** (EF) is an important one to understand when thinking about heart failure.

EF is the proportion of blood inside of the ventricle that gets "ejected" when the ventricle contracts.

(FYI, ejection fraction is measured clinically using ultrasound—**echocardiography**. Normal is 55–70%.)

In **systolic** heart failure, the failure interferes with **systole**—the **contraction** of the heart—preventing as much blood from being ejected.

We also call this **HFrEF**: heart failure with **reduced** ejection fraction.

In **diastolic** heart failure, the failure interferes with **diastole**—the **filling** of the during expansion—but the contraction is unaffected.

We also call this **HFpEF**: heart failure with **preserved** ejection fraction.

QUESTION 7

Compare high- and low-output heart failure.

High-output heart failure is sort of a third type of HF in which the cardiac output is actually **greater** than normal.

In HFrEF and HFpEF (both **low-output** HF,) CO decreases due to either impaired contraction or impaired filling.

In **high-output** HF, a decrease in blood pressure causes low systemic resistance, but the heart pumps harder because the **demand** for oxygen is chronically increased, usually due to some underlying condition.

The concern here is not as much with oxygen delivery, but rather that the heart is using excess **energy** and the body may not be able to keep up with its **metabolic** needs.

QUESTION 8

Why would most cases of heart failure be chronic?

In some cases, heart failure can be "fixed"—for example, if the cause is high BP, taking meds to get the BP under control will give the heart an easier time.

However, in **most cases**, the underlying cause is not really fixable and the best treatment is simply management to keep the condition from causing O_2 problems.

QUESTION 9

What are some disorders that may lead to acute heart failure?

- Incompetent heart valves (e.g. mitral stenosis/regurgitation)
- Hypertension (congestive heart failure)
- Hyperthyroidism (high-output heart failure)
- Anemia (more blood to deliver same amount of O_2)

QUESTION 10

Why are inotropic drugs used to treat heart failure?

Inotropic agents assist with heart failure by increasing the **force of contraction** of the heart, **offsetting** the underlying problem causing poor heart function.

Many also have positive **chronotropic** effects, meaning that they increase the **heart rate** which also improves cardiac output.

The prototypical positive inotropic agent is **digoxin**, although it is no longer used as much due to narrow therapeutic range and potentially severe adverse effects.

You may see other drugs such as **milrinone** and **dobutamine** used more often in a clinical setting.