

# AI-03461 Heart Function Explained

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Tags	MD
Created time	@February 11, 2026 8:33 AM

**I want to understand the human heart—how it works, what its main parts do, and what happens when things go wrong. I’m especially interested in concepts like heart failure, ejection fraction, stroke volume, and heart rate, explained in plain language for a non-medical audience.**

Love this question. The heart is one of those organs that sounds mystical, but once you see it as a living pump with feedback loops, it actually becomes very understandable—and kind of amazing.

I'll walk you through it in layers, plain-language first, no medical jargon unless it helps.

## 1. What the heart is, at its core

The heart is a muscular pump about the size of your fist.

Its job is simple:

Move blood so oxygen, nutrients, and signals reach every cell—and waste gets taken away.

If blood stops moving → organs fail → life stops.

So everything the heart does is about flow.

## 2. The main parts (no anatomy overload)

### The four chambers

Think of the heart as a two-story, two-room house:

Top floor (atria) – receiving rooms

- Right atrium: receives blood from the body (low oxygen)
- Left atrium: receives blood from the lungs (high oxygen)

Bottom floor (ventricles) – pumping rooms

- Right ventricle: pumps blood to the lungs
- Left ventricle: pumps blood to the entire body (this is the powerhouse)

👉 The left ventricle does the hardest work and is central to heart failure discussions.

### **The valves (one-way doors)**

Valves make sure blood flows forward only, not backward—like check valves in plumbing.

If valves leak or stiffen → efficiency drops → the heart has to work harder.

## **3. How a heartbeat actually works**

Each beat has two main phases:

1. Filling (relaxing) – the heart opens up and fills with blood
2. Pumping (contracting) – the heart squeezes blood out

This happens ~60–100 times per minute at rest.

## **4. Three key ideas that explain almost everything**

### **A. Heart Rate (HR)**

Heart rate = how often the heart beats per minute

- Slow HR → fewer pumps per minute
- Fast HR → more pumps per minute (but less time to fill)

Heart rate is controlled automatically by your nervous system based on:

- Activity
- Stress
- Illness
- Medications

## **B. Stroke Volume (SV)**

Stroke volume = how much blood is pumped out with each beat

Think of it as:

“How full the heart gets” + “how strongly it squeezes”

- Bigger fill → bigger push
- Stronger muscle → more blood per beat

A healthy adult might pump ~70 mL per beat.

## **C. Cardiac Output (the big picture)**

This is the total blood flow per minute.

Cardiac Output = Heart Rate × Stroke Volume

So the body can increase blood flow by:

- Beating faster
- Pumping more per beat
- Or both

# **5. Ejection Fraction (EF) — demystified**

This one scares people because it sounds technical.

## **What it really means:**

Ejection fraction = the percentage of blood in the ventricle that gets pumped out with each beat

Example:

- Heart fills with 100 mL

- Pumps out 60 mL
- EF = 60%

### **What's normal?**

- 55–70% = normal
- Below that → weaker pumping

Important insight:

EF is about efficiency, not volume.

You can have:

- Normal EF but low output (small heart or stiff filling)
- Low EF but still functioning okay at rest

## **6. What is heart failure, really?**

Heart failure does not mean the heart stops.

It means:

The heart cannot keep up with the body's demands without strain.

There are two main ways this happens:

### **A. Pump failure (reduced EF)**

The heart muscle is weak and can't squeeze well.

Causes:

- Prior heart attack
- Long-term high blood pressure
- Dilated heart muscle

Result:

- Low stroke volume
- Blood backs up
- Fatigue, breathlessness, fluid buildup

## **B. Filling failure (preserved EF)**

The heart squeezes fine, but it's stiff and doesn't fill well.

Causes:

- Aging
- High blood pressure
- Diabetes

Result:

- Normal EF
- Small stroke volume
- Same symptoms as above

👉 This is why EF alone doesn't tell the full story.

# **7. Why symptoms happen**

## **Shortness of breath**

Blood backs up into the lungs → fluid leaks into air spaces.

## **Swelling in legs or belly**

Blood backs up in veins → fluid leaks into tissues.

## **Fatigue**

Muscles and brain get less oxygen and fuel.

# **8. Why the body makes things worse (unintentionally)**

When output drops, the body panics:

- Raises heart rate
- Tightens blood vessels
- Holds onto salt and water

Short term: helpful

Long term: overworks the heart

Many heart medications exist to calm these reflexes, not just “boost” the heart.

## 9. A simple mental model

Think of the heart as:

- A pump
- With a tank (filling)
- A motor (muscle strength)
- Pipes (blood vessels)
- A control system (nerves & hormones)

Heart disease happens when any part of that system becomes inefficient.

## 10. One grounding truth

People often fear heart numbers (EF, HR, BP).

But the heart is adaptive, not fragile.

With the right conditions:

- It remodels
- It rests
- It recovers more than people expect

If you want, next we can:

- Build a visual analogy (car engine, pump, or traffic system)
- Explain why certain heart meds slow the heart on purpose
- Talk about exercise and why it helps failing hearts
- Or go deeper into EF vs real-world function

Just tell me which thread you want to pull ❤️