
IN THE NAME OF GOD

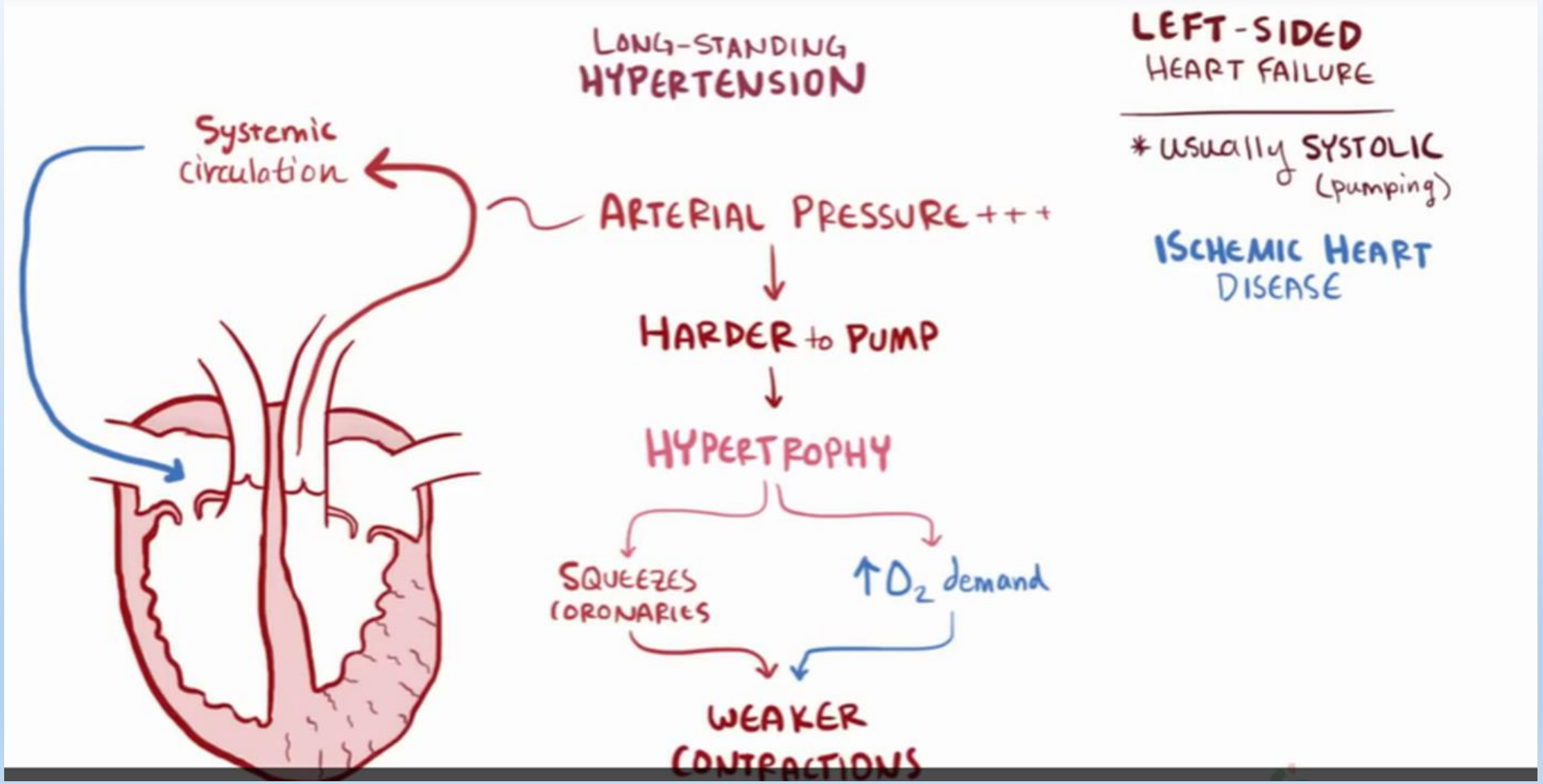
PATHOLOGY & CAUSES

- A complex clinical syndrome characterized by the heart's inability to effectively fill and/or eject (pump) blood. Because pumping section of heart called ventricles maybe weakened or damaged.

Heart failure (HF) with reduced ejection fraction (HFrEF)

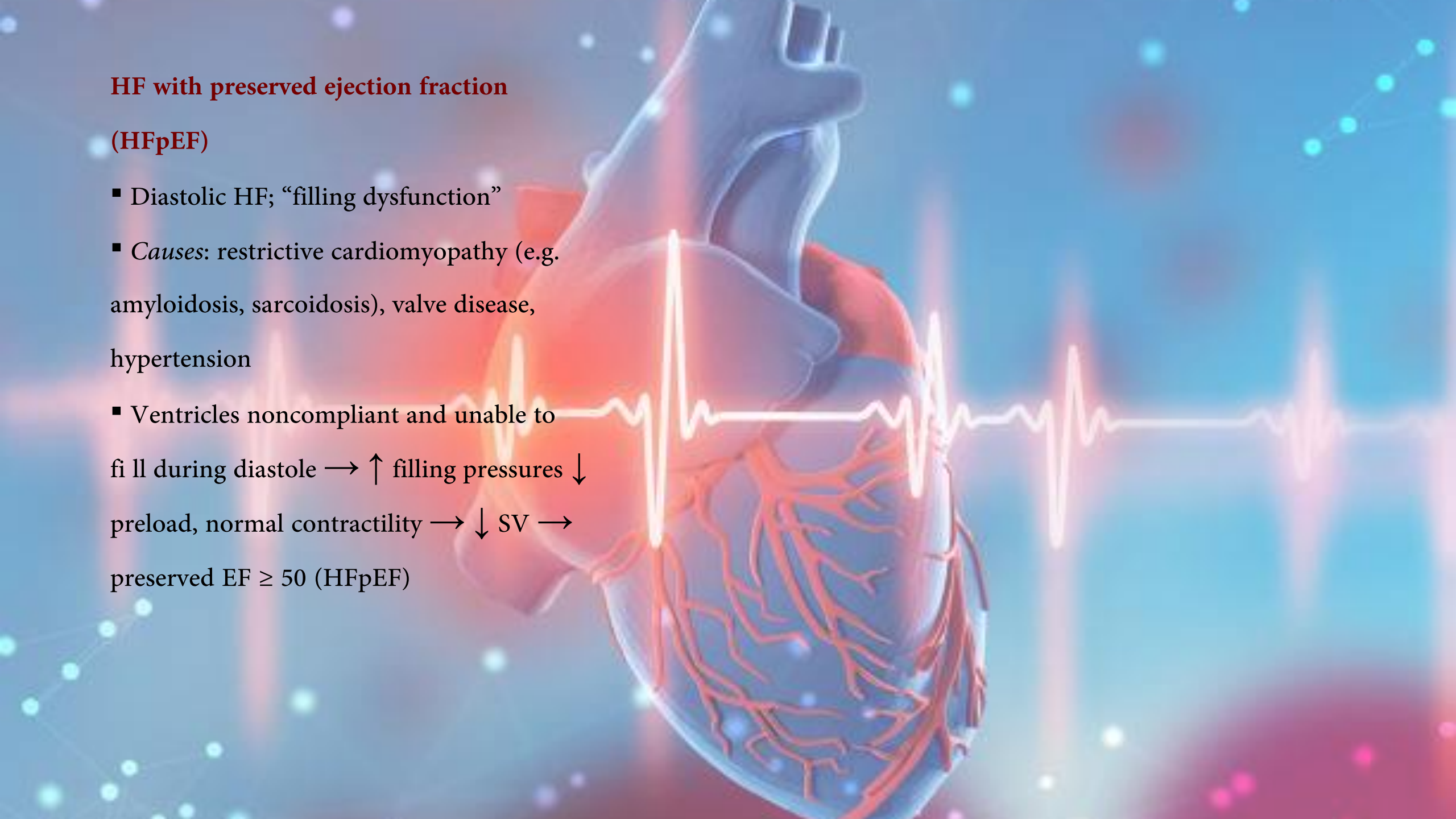
- Systolic HF; "pump dysfunction"
- Causes: ↓ contractility/force of contraction (e.g. myocardial infarction, myocarditis), ↓ blood supply to the heart (e.g. coronary artery disease), ↑ afterload (e.g. hypertension), impaired mechanical function (e.g. valve disease)

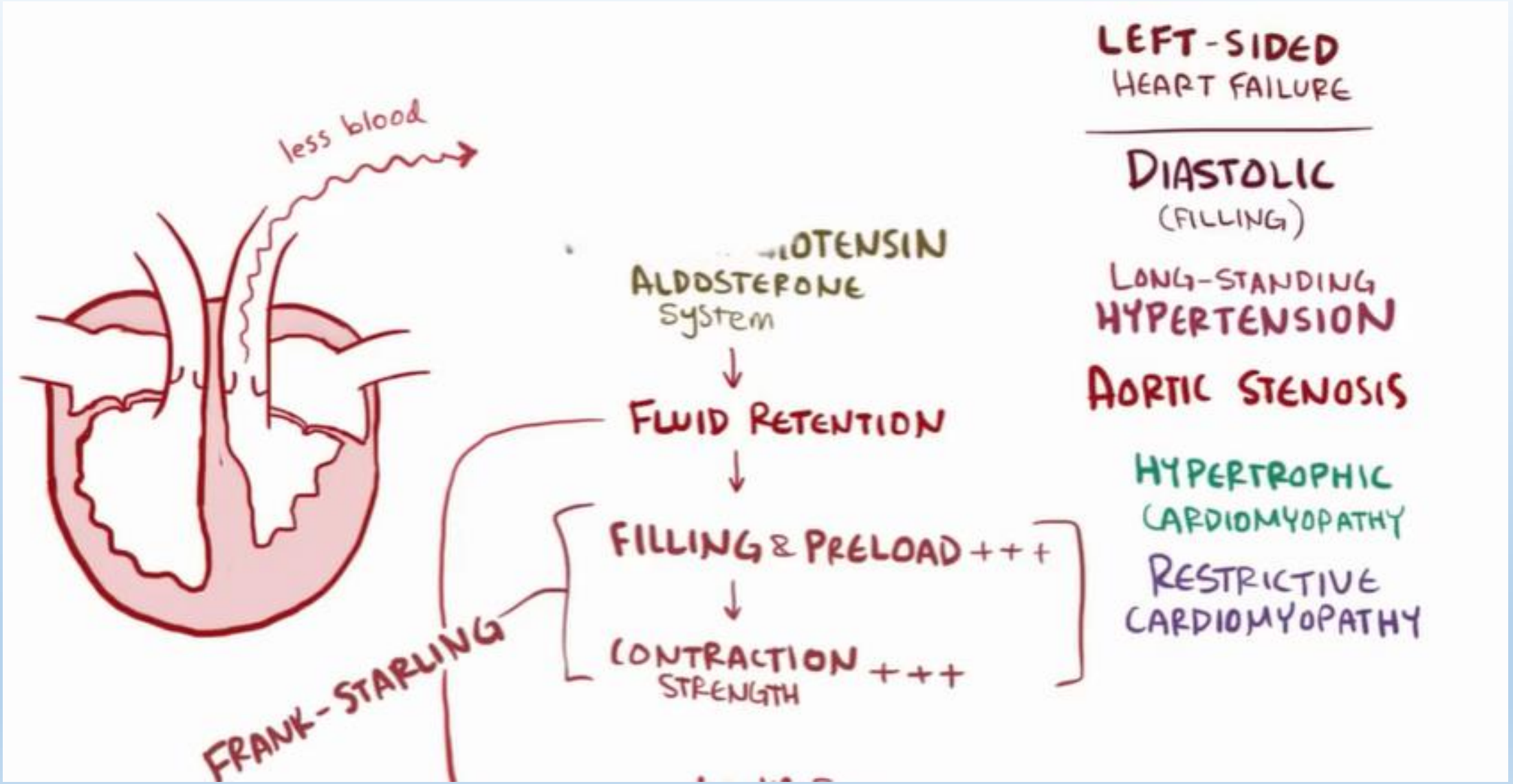
- Normal preload, ↓ contractility (inotropy; force of contraction) ⟶ inadequate emptying of ventricles during systole ⟶ ↓ EF ≤ 40 (HFrEF); often also have some degree of diastolic dysfunction


LONG-STANDING
HYPERTENSION
Systemic
circulation
ARTERIAL PRESSURE +++
HARDER to PUMP
HYPERTROPHY
SQUEEZES
CORONARIES
↑O_2 demand
WEAKER
CONTRACTIONS
LEFT-SIDED
HEART FAILURE
* usually SYSTOLIC
(pumping)
ISCHEMIC HEART
DISEASE

HF with preserved ejection fraction (HFpEF)

- Diastolic HF; “filling dysfunction”
- *Causes*: restrictive cardiomyopathy (e.g. amyloidosis, sarcoidosis), valve disease, hypertension
- Ventricles noncompliant and unable to fi ll during diastole ⟶ ↑ filling pressures ↓ preload, normal contractility ⟶ ↓ SV ⟶ preserved EF ≥ 50 (HFpEF)




less blood
LEFT-SIDED
HEART FAILURE
DIASTOLIC
(FILLING)
LONG-STANDING
HYPERTENSION
AORTIC STENOSIS
HYPERTROPHIC
CARDIOMYOPATHY
RESTRICTIVE
CARDIOMYOPATHY
OTENSIN
ALDOSTERONE
System
FLUID RETENTION
FILLING & PRELOAD +++
CONTRACTION
STRENGTH +++
FRANK-STARLING

Types:

- Biventricular heart failure

Left, right failure; systolic/diastolic

- Cor pulmonale

Heart failure secondary to any cause of pulmonary arterial hypertension

- Left-sided heart failure

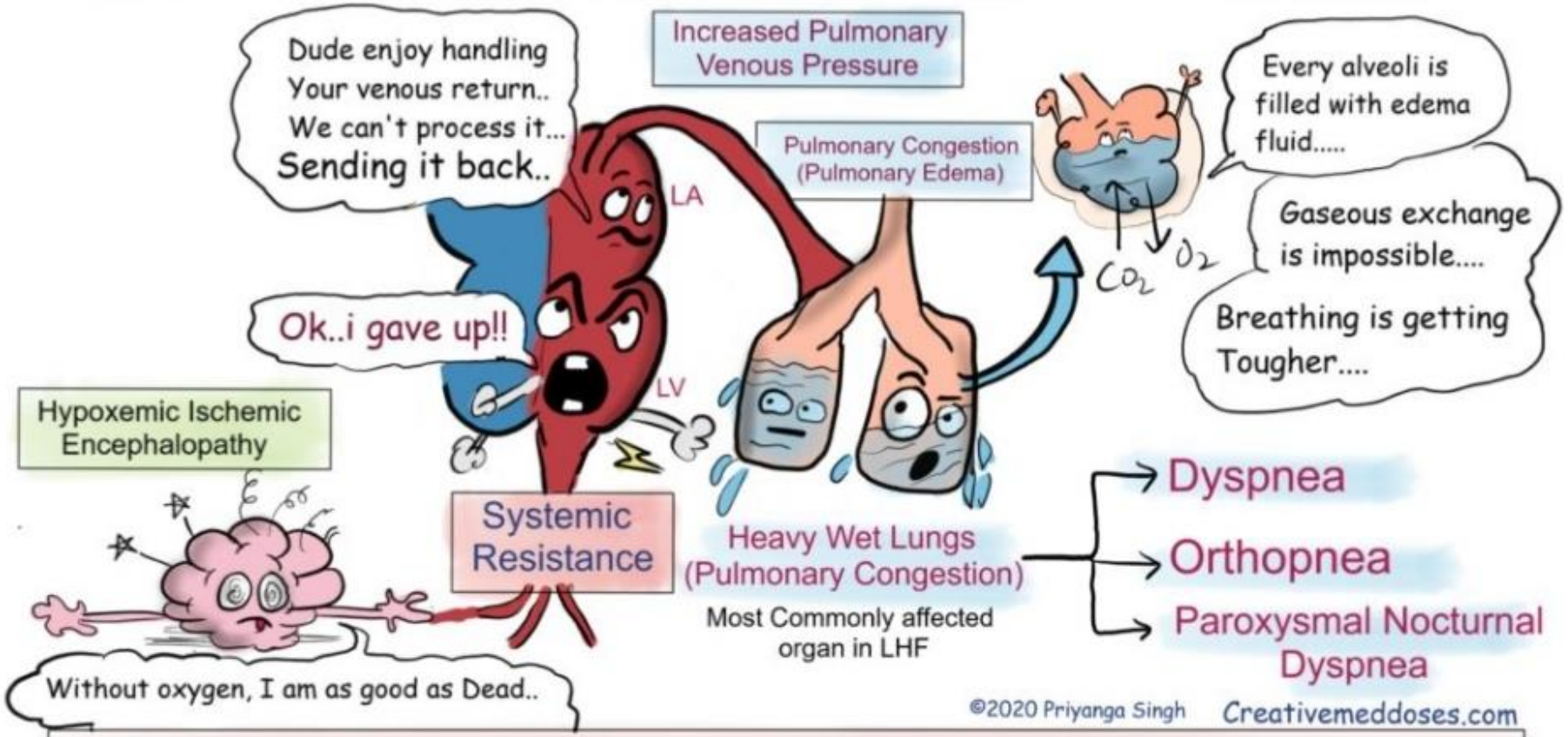
Impaired ability of the left ventricle to maintain adequate cardiac output without an increase in left-sided filling pressures

- Right-sided heart failure

Impaired ability of the right ventricle to deliver of blood fl ow to the pulmonary circulation and ↑ right atrial pressure

Left-sided Heart Failure

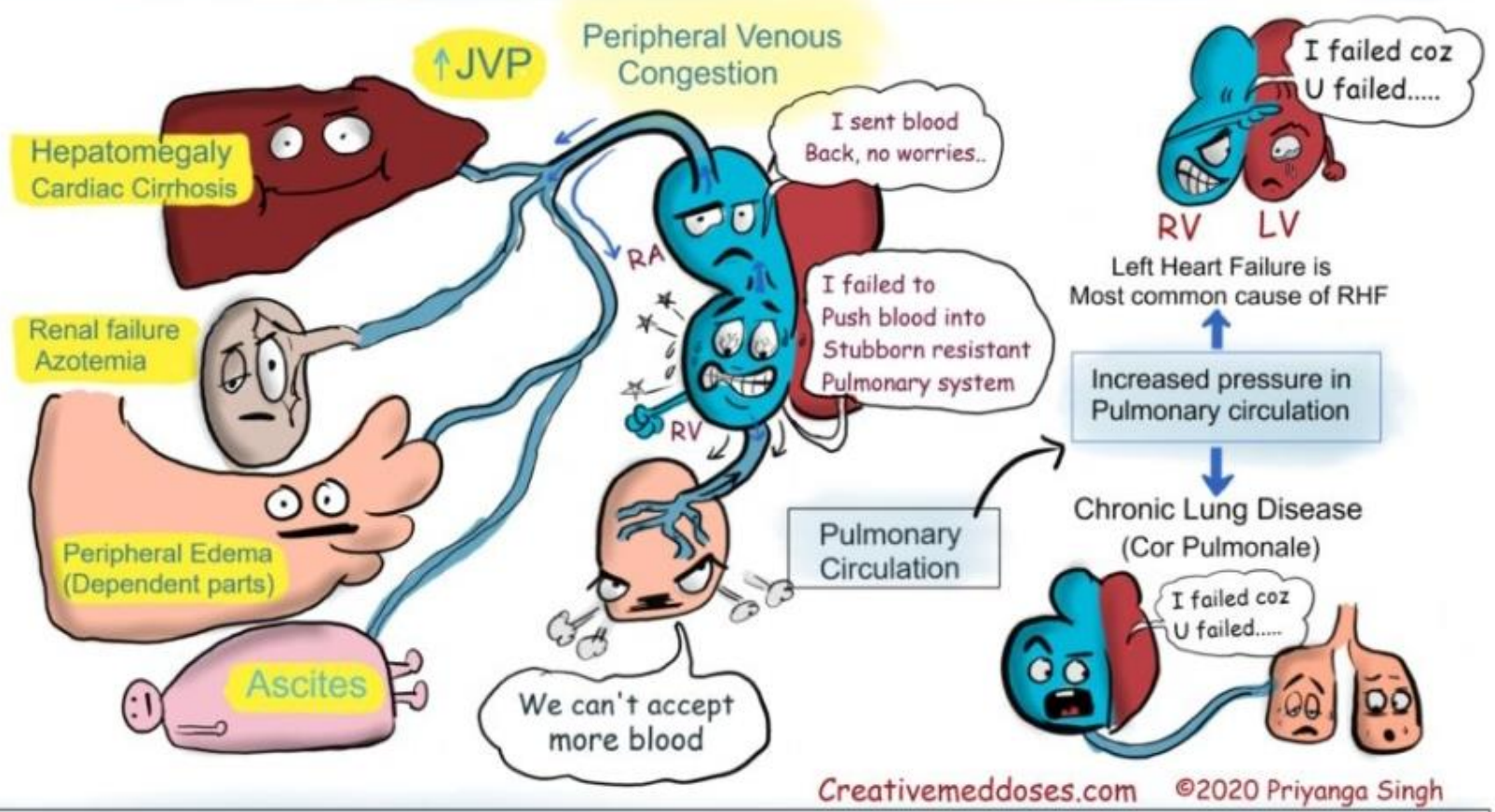
Left side ⟶ Venous Return from Lungs ⟶ Failure leads to Pulmonary Congestion & Pressure



Left side ⟶ Supply Body Organs ⟶ Failure leads to low organ perfusion and hypoxia

Right-Sided Heart Failure

Right side → Venous return from body organs (except Lungs) → Failure leads to- venous congestion of body organs



Right side → Pumps blood into Lungs → Failure happens because of- Increased pulmonary vascular pressure

RISK FACTORS

- *Cardiac disorders*: ischemic heart disease, valvular heart disease, hypertension, LV hypertrophy, peripartum cardiomyopathy, myocarditis, congenital heart disease, chronic tachyarrhythmias
- *Other chronic diseases*: hypertension, diabetes, obesity, chronic lung disease, infiltrative diseases (e.g. amyloidosis)
- *Toxins*: cigarette smoking, ethanol, cardiotoxic medications (e.g. doxorubicin, amphotericin B); illicit drugs (e.g. amphetamines, cocaine)
- *High-output states*: thyrotoxicosis, anemia
- ↑ age

COMPLICATIONS

- Cardiogenic shock
- Biventricular heart failure
  - Left/right-sided HF precursor complication of each other
- Arrhythmias
- End organ damage: due to lack of perfusion
- Liver damage (congestive hepatopathy)
- Exacerbation
  - See mnemonic
  - Certain drugs may exacerbate HF; e.g. NSAIDs, excessive doses of beta blockers, calcium channel blockers, cyclophosphamide

Causes of Exacerbation of Heart failure:

Forgot medication

Arrhythmia/Anemia

Ischemia/Infarction/Infection

Lifestyle (e.g. too much salt)

Upregulation of CO (e.g. pregnancy, hyperthyroidism)

Renal failure

Embolism (e.g. pulmonary)

MNEMONIC: FAILURE

ACUTE HEART FAILURE CLASSIFICATION

IS PERFUSION LOW?	IS CONGESTION PRESENT?	
	NO	**YES**
NO	**Warm & Dry** (Compensated) PCWP normal CI normal	**Warm & Wet** (Congested) PCWP elevated CI normal
YES	**Cold & Dry** (Low flow state) PCWP low/normal CI decreased	**Cold & Wet** (Decompensated) PCWP elevated CI decreased

Sign and symptoms:

- *High filling pressures*: pulmonary edema, dyspnea, orthopnea, exercise intolerance, paroxysmal nocturnal dyspnea (PND), basilar crackles, tachypnea, jugular venous distention (JVD), hypoxemia, fatigue, peripheral edema, hepatomegaly, S3
- *Low cardiac output*: tachycardia, hypotension, cool extremities, ↓ pulse pressure, ↓ urine output, ↓ appetite, difficulty focusing , confusion,.

Signs and symptoms of Heart Failure

Ascites (swelling in abdomen)

Fluid surrounding the lungs

Raised JVP

Tiredness and shortness of breath

Edema (swelling in legs)

Chest pain

Enlarged liver

Diagnosis:

- **DIAGNOSTIC IMAGING**

I. Chest X-ray

II. Doppler echocardiography

III. Right heart (pulmonary artery) catheterization

IV. MRI

- **LAB RESULTS**
- **OTHER DIAGNOSTICS**

DIAGNOSTIC IMAGING

Chest X-ray

- Detects cardiomegaly, chamber and vessel enlargement, pulmonary congestion, presence of pericardial and pleural effusions

Doppler echocardiography

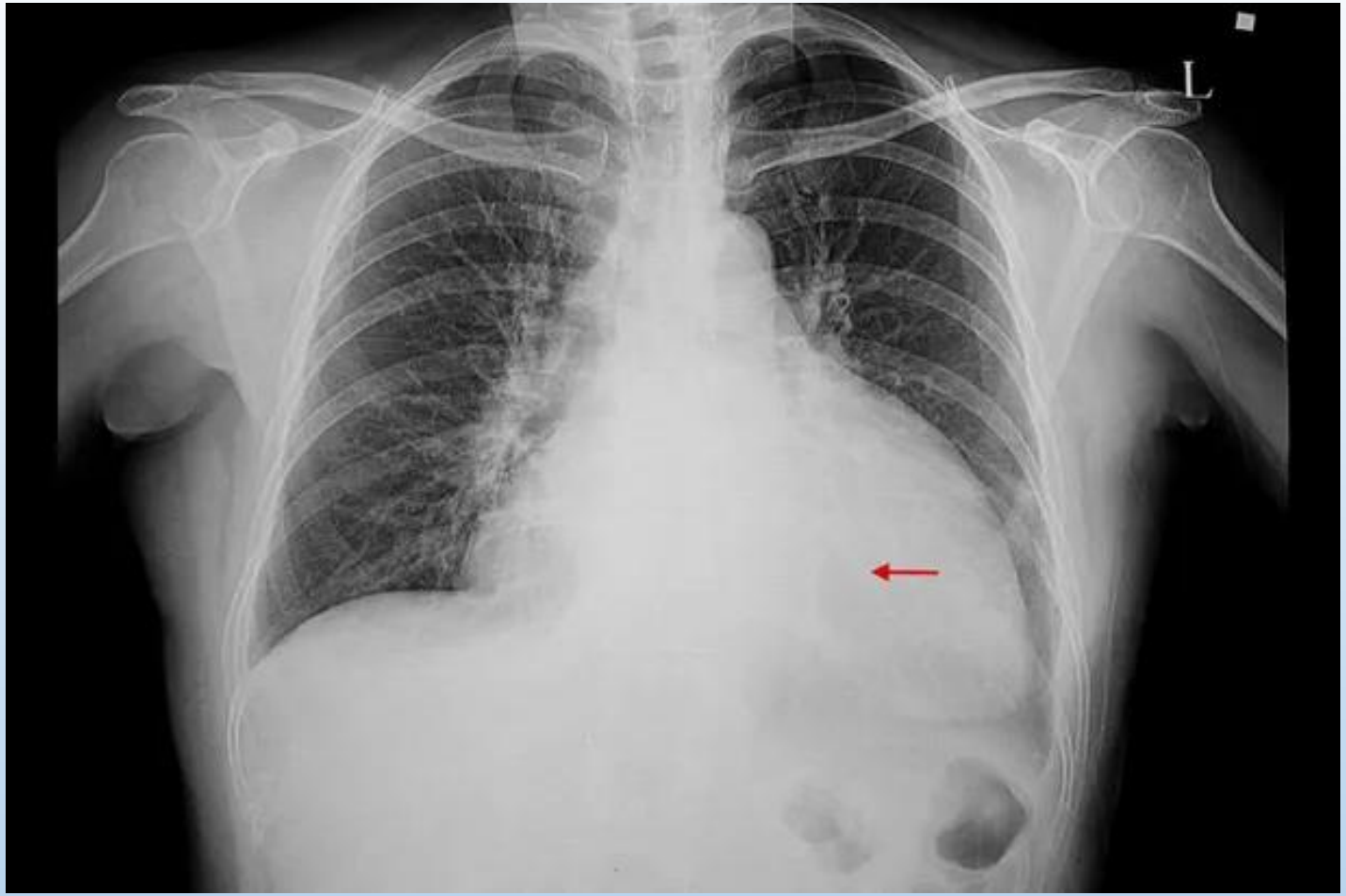
- Evaluates hemodynamics related to in valvular and biventricular function

Right heart (pulmonary artery) catheterization

- Measures CO (cardiac index), filling pressures, pulmonary capillary wedge pressure (PCWP)

MRI

- Visualizes ventricular volumes, mass, presence of myocardial remodeling



Cardiomegaly and kerley line in CXR

Lab results:

- ↑ B-type natriuretic peptide (BNP) and/or N-terminal pro-BNP
- ↑ serum creatinine and blood urea nitrogen (BUN) indicates glomerular filtration rate ↓ GFR due to hypoperfusion.
- ↑ serum total bilirubin and aminotransferase indicates congestive hepatopathy from right-sided HF
- ↑ serum lactate if cardiogenic shock
- Exercise testing: six-minute walk test and/or a cardiopulmonary exercise test measuring oxygen uptake (Vo2) evaluates exercise capacity

Other diagnosis:

- History and physical examination

identifying characteristic symptoms,

evidence of fluid retention and/or

hypoperfusion and functional impairment

due to cardiac dysfunction

ECG

- Identifies contributing rhythm disturbances

Heart failure video :

https://app.cardiovisual.com/UnderstandingHeartFailure

https://t.me/Vid_OnlineMedEds/662

The end….