Chronic heart failure

IInd Chair and Clinic of Cardiology

Definition

Heart failure (HF) is a condition in which a problem with the structure or function of the heart impairs its ability to supply sufficient blood flow to meet the body's needs.

Braunwald 1980r.

Epidemiology

- Prevalence: 2 – 3% of the population
  - raise rapidly after 75 yo, prevalence in population 70-80 yo is about 10-20%
- Increasing prevalence because of:
  - aging,
  - available forms of treatment in a group of patients with cardiovascular diseases

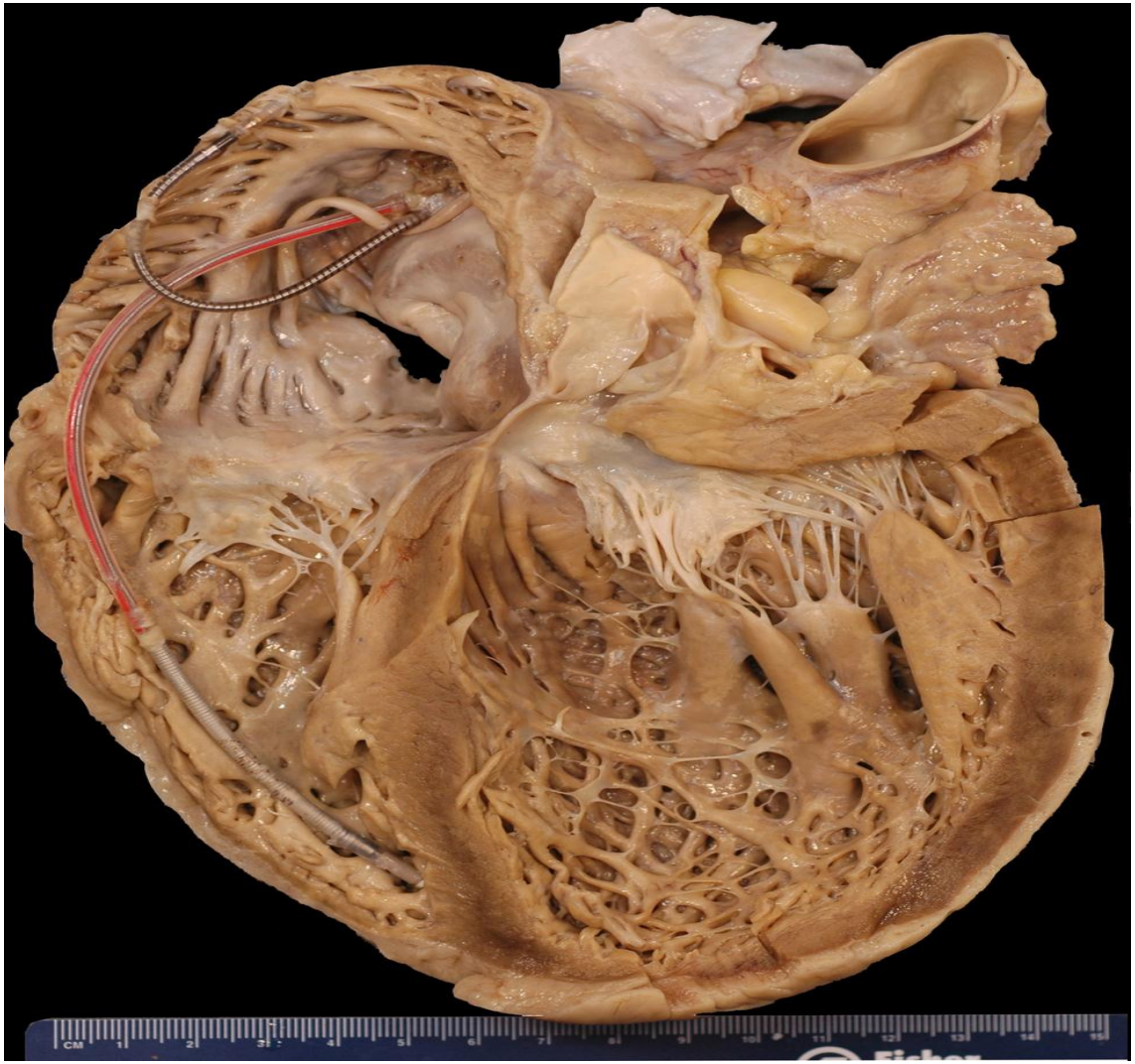
Epidemiology

- CHF is a cause of 5% emergency hospital admissions,
- Unfavourable prognosis:
  - 50% of patients die within following 4 years
  - 40% of patients treated in hospital die or need rehospitalization in 1 year

Main causes of HF

- Ischemic heart disease – 70%
- Valvular heart disease – 10%
- Cardiomyopathies – 10%
- Hypertension

Dilated cardiomyopathy (DCM)



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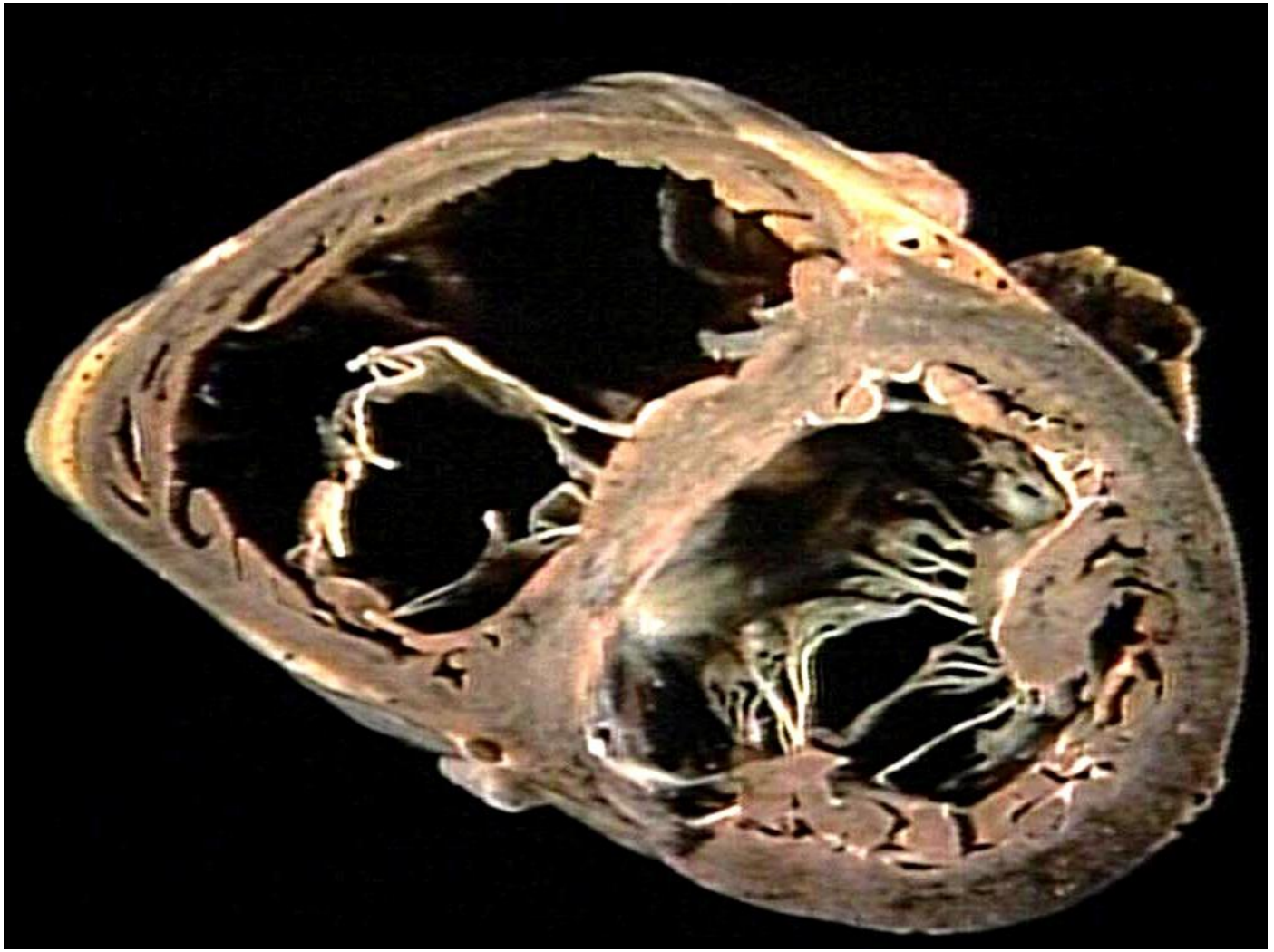


Rare causes of HF

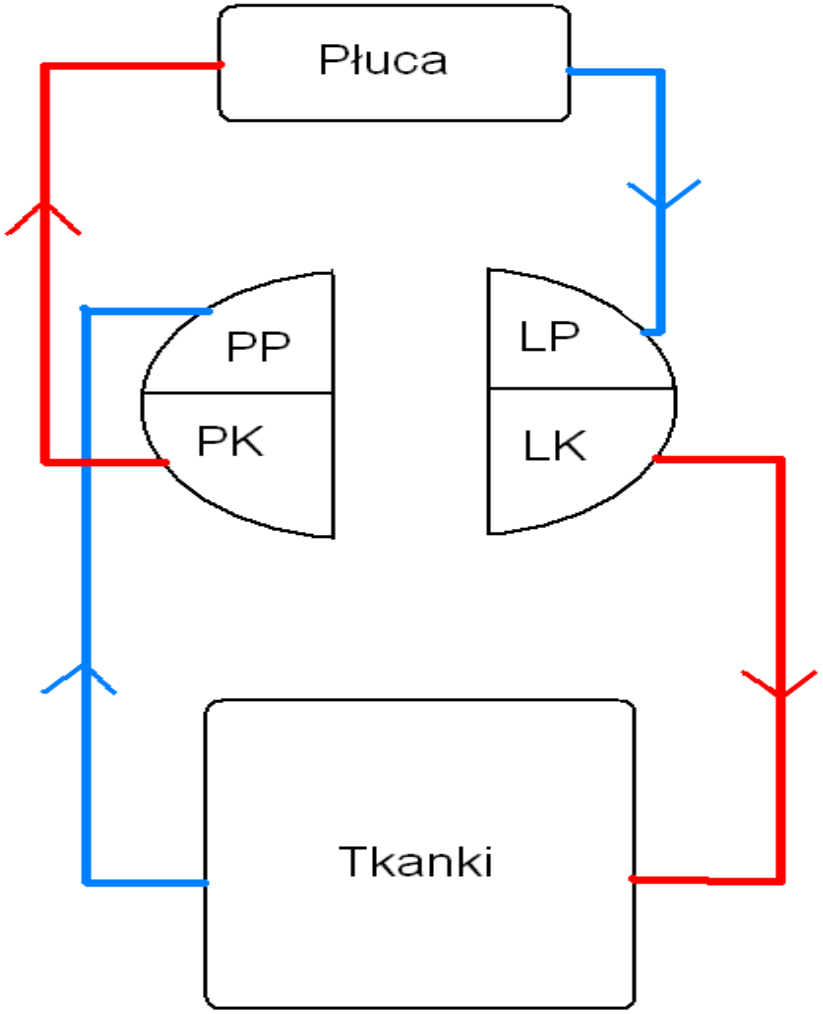
- Drugs (beta-blockers, Calcium-blockers, antyarrhytmic drugs)
- Toxins (alcohol, drugs, cocaine, mercury, cobalt)
- Endocrine diseases (diabetes mellitus, hyper/hypothyroidism, Cushing syndrome, pheochromocytoma)
- Nutritional (deficiency of thiamine, selenium, karnitine, obesity, cachexia)
- Infiltrative (sarcoidosis, amyloidosis, hemochromatosis)
- Others (Chagas disease, HIV, peripartum cardiomiopathy)

Heart failure

- Acute
- Chronic

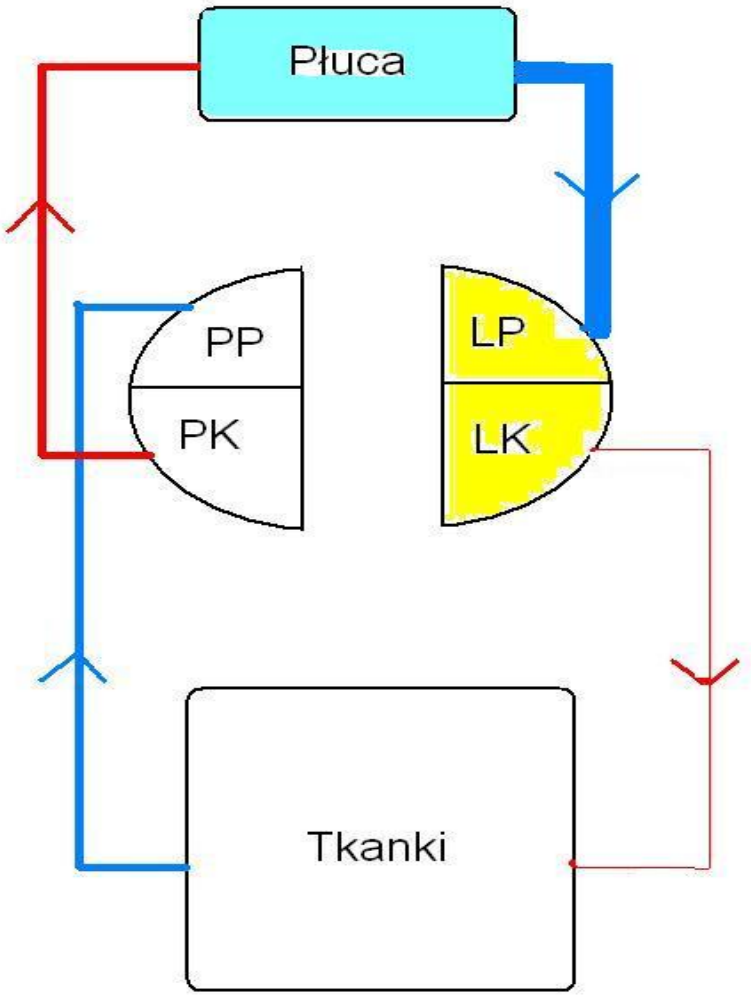
- Right-sided
- Left-sided

Pathophysiology



- Systemic circulation

Left ventricular dysfunction



- Leads to:
  - pulmonary congestion
  - impaired tissue blood flow

Symptoms of left-sided HF

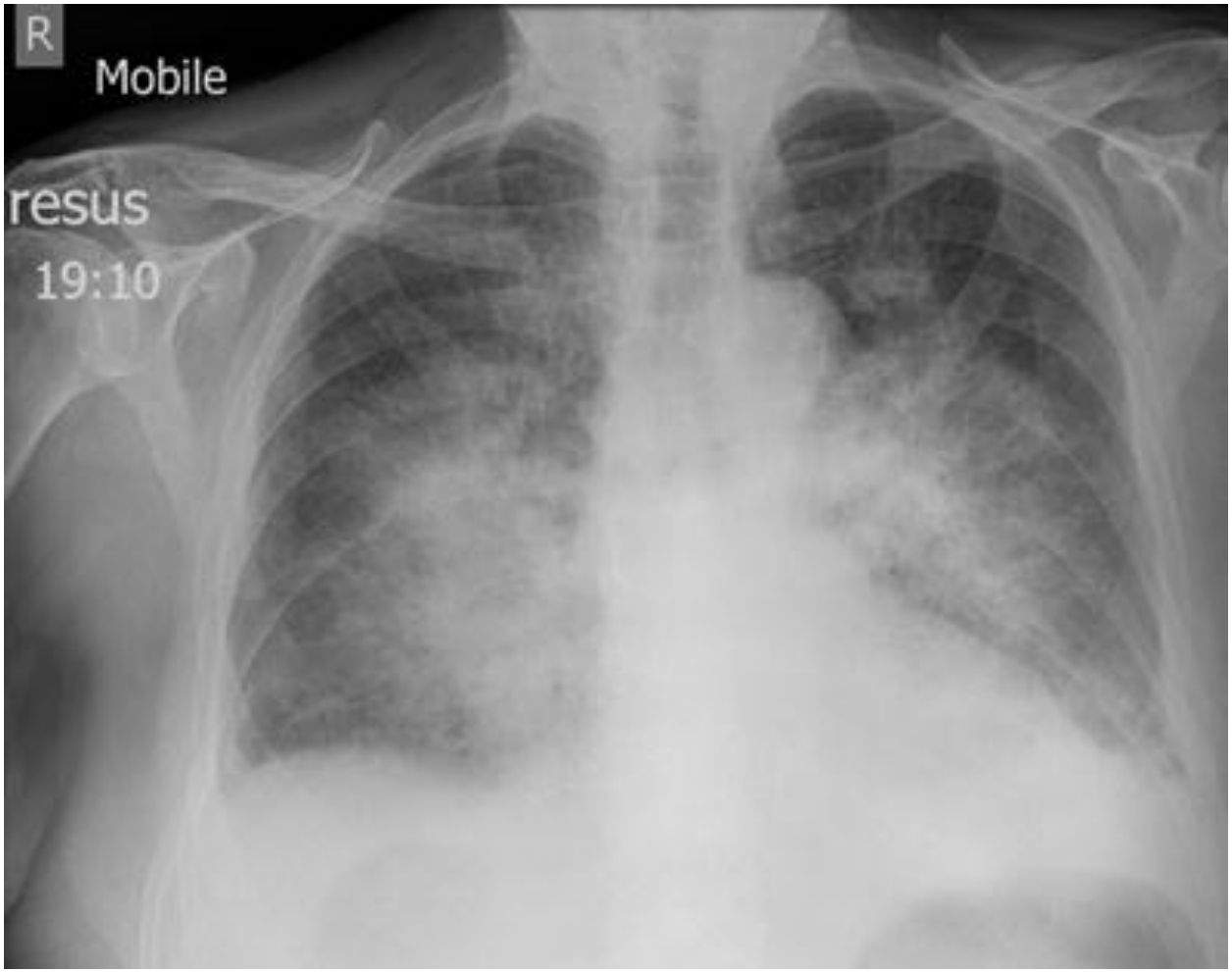
- Related with pulmonary congestion:
  - Dyspnea
  - Ortopnea
  - Cough
  - Pulmonary rales
- Related with impaired tissue blood flow :
  - Fatigue
  - Syncope
  - Cyanosis

Dyspnea

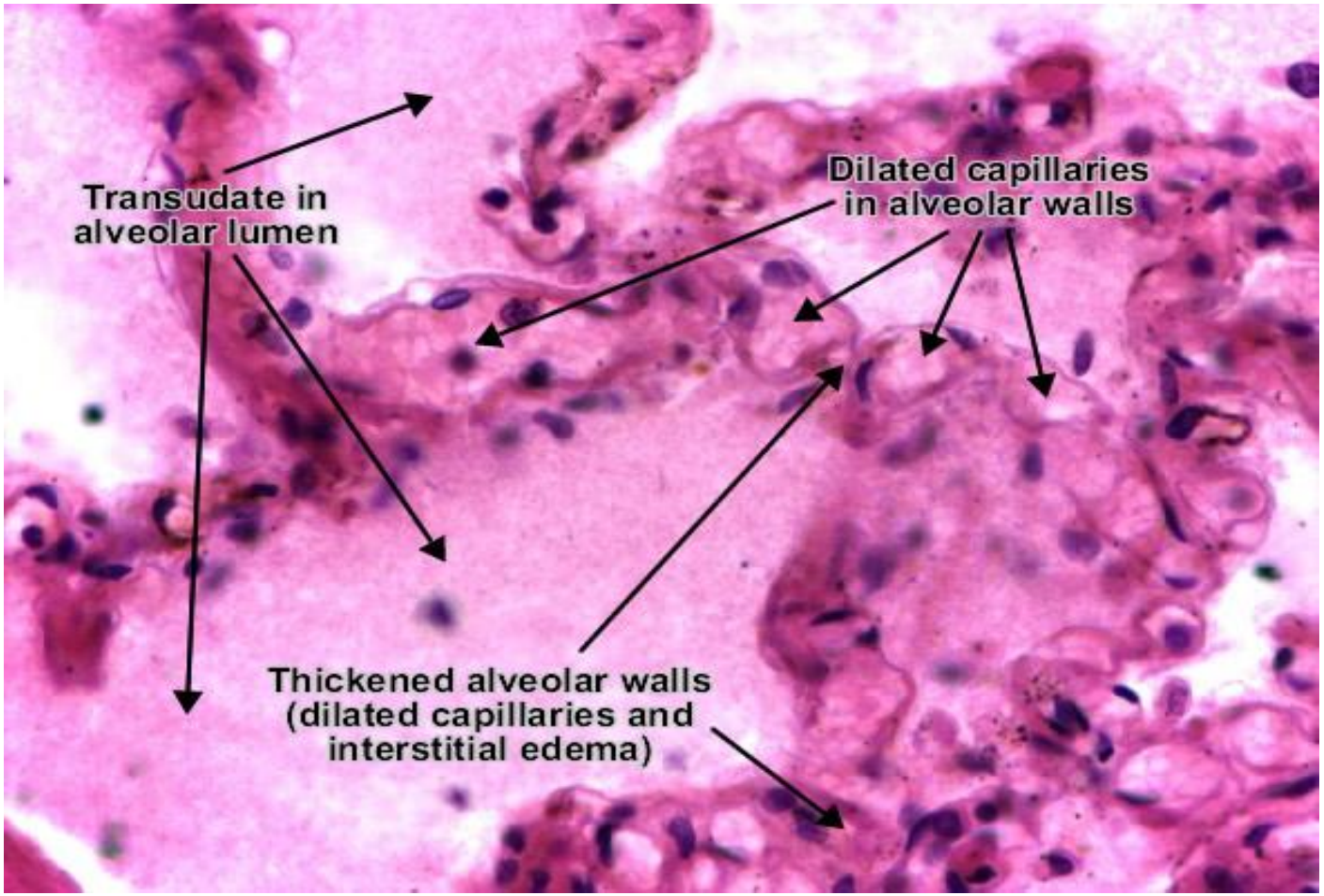
- Consequence of pulmonary congestion > lung stiffness > intensified respiratory muscles workload >dyspnea
- Postacie :
  - Initially exertional ➡ at rest
  - Orthopnoe (dyspnea increases in recumbent position), sometimes nocturnal dyspnea (attacks of severe shortness of breath that occur at night and may subside after sitting upright

orthopnoe

Pulmonary edema

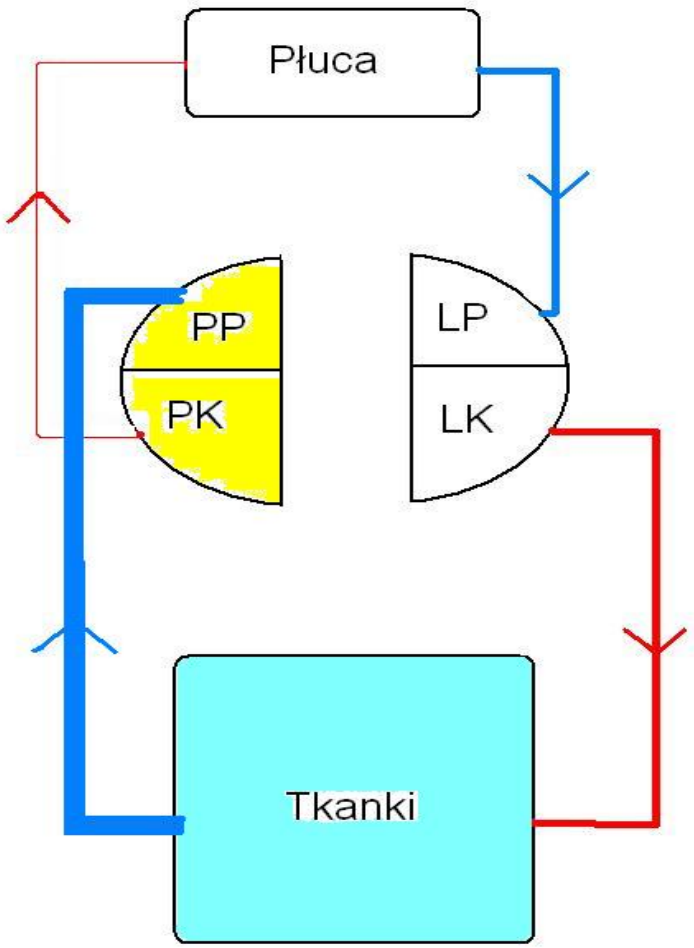


Pulmonary edema – pathological findings



Cyanosis

Right-sided HF

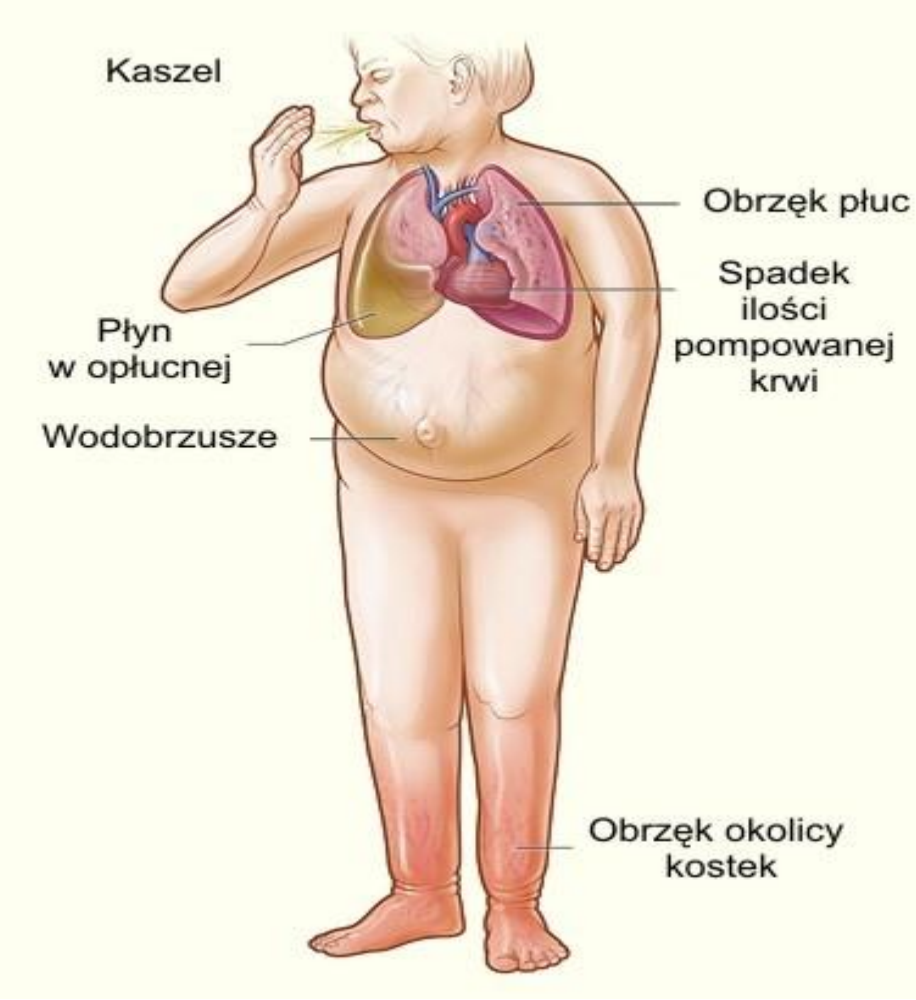


- Leads to:
  - perpheral edema
  - reduced pulmonary blood flow

Symptoms of right-sided HF

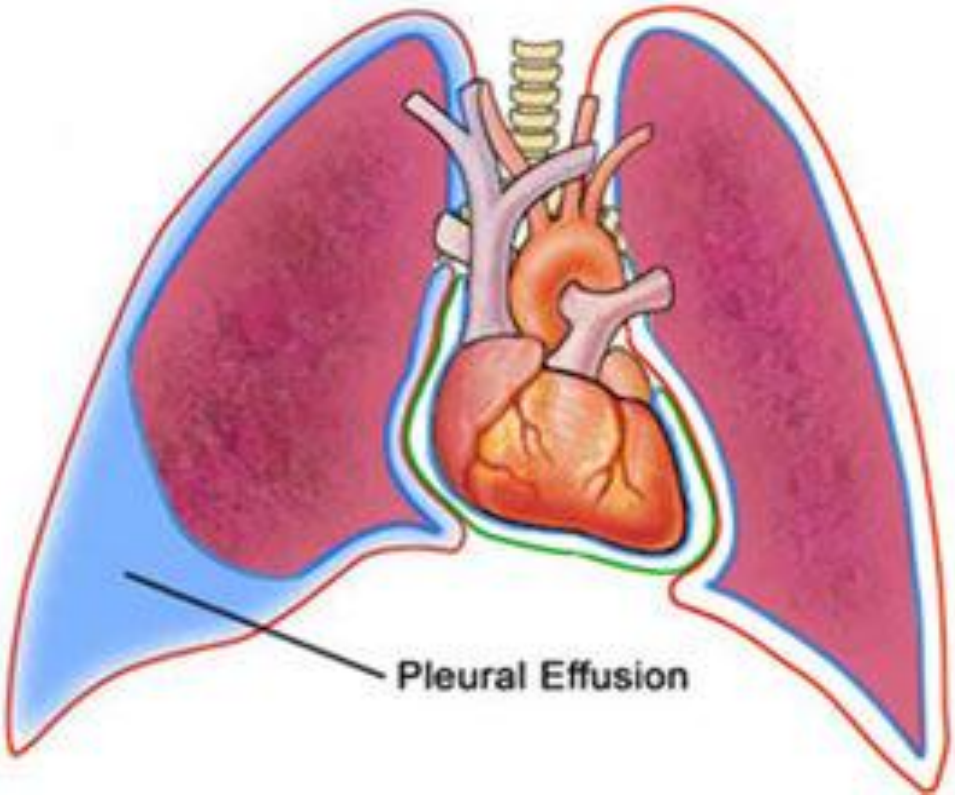
- Related with perpheral edema
  - Distention of the jugular veins
  - Swelling
  - Hydrothorax and ascites
  - Hepatomegaly

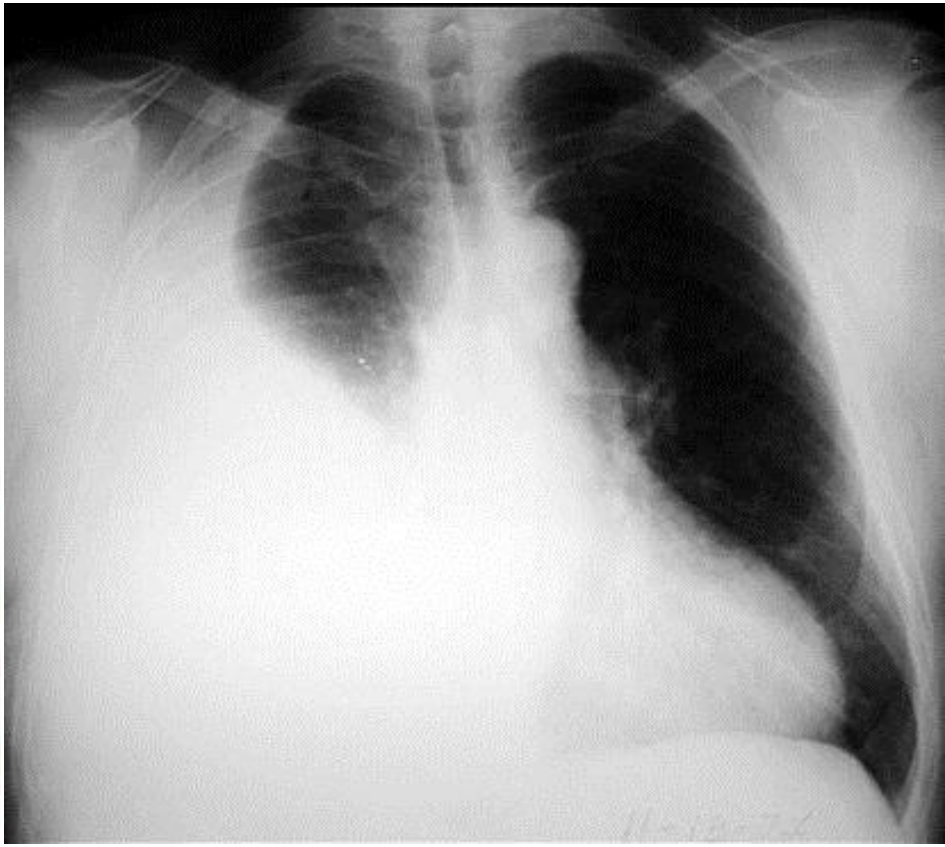
Symptoms of HF



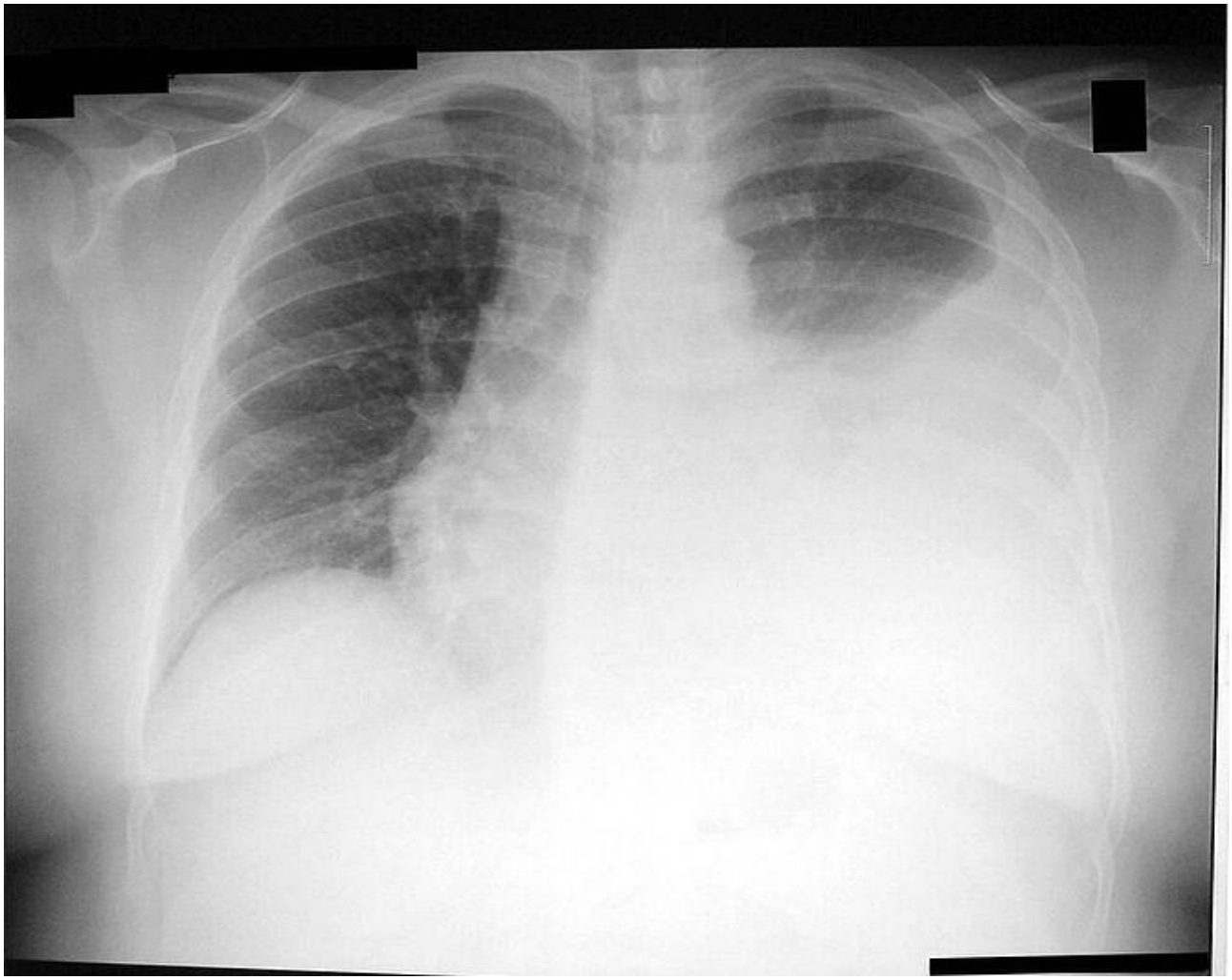
Edema

Hydrothorax

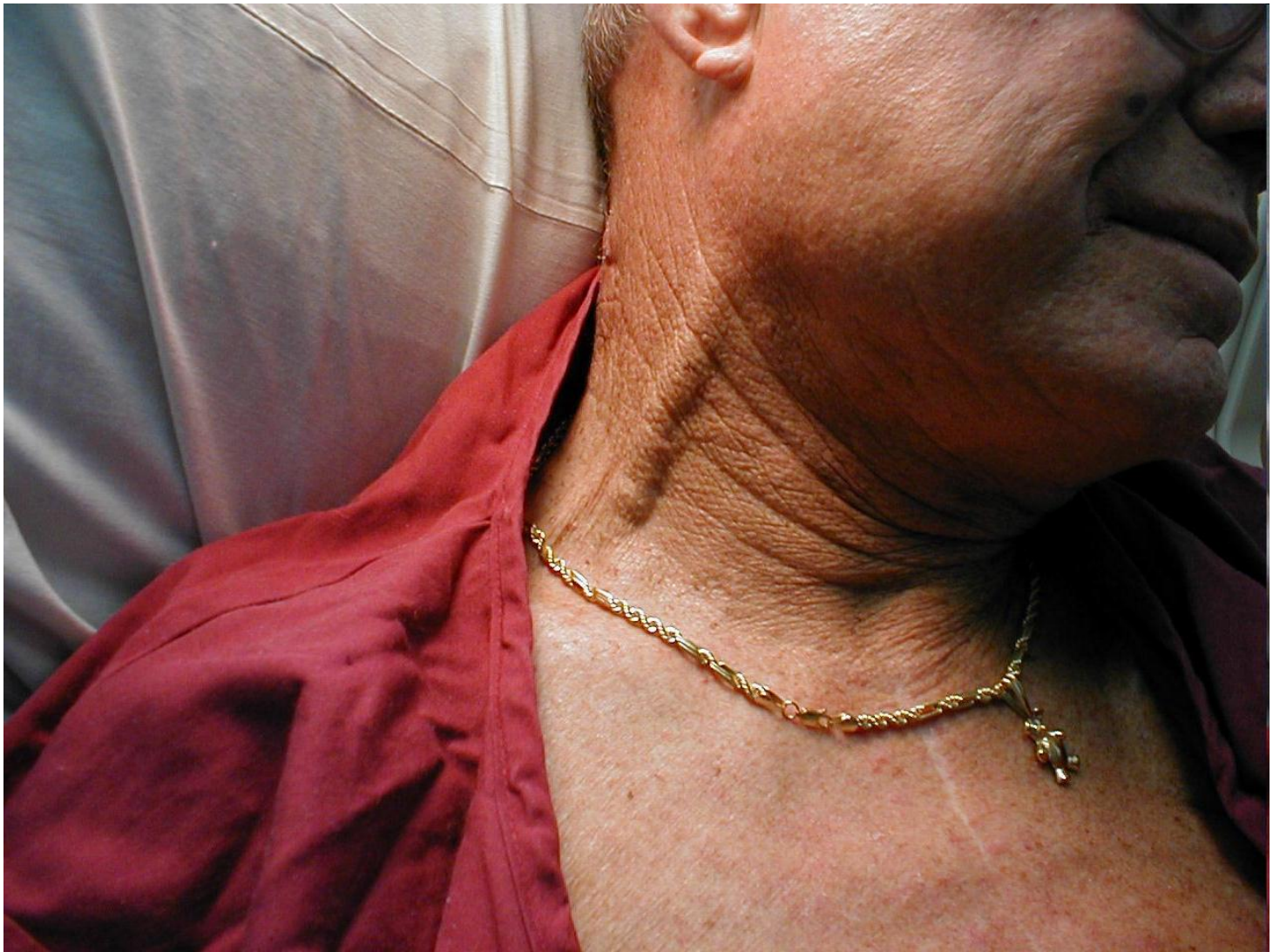




Hydrothorax



Jugular vein distention



NYHA classification

The classes (I-IV) are:
Class I: no limitation is experienced in any activities; there are no symptoms from ordinary activities.
Class II: slight, mild limitation of activity; the patient is comfortable at rest or with mild exertion.
Class III: marked limitation of any activity; the patient is comfortable only at rest.
Class IV: any physical activity brings on discomfort and symptoms occur at rest.

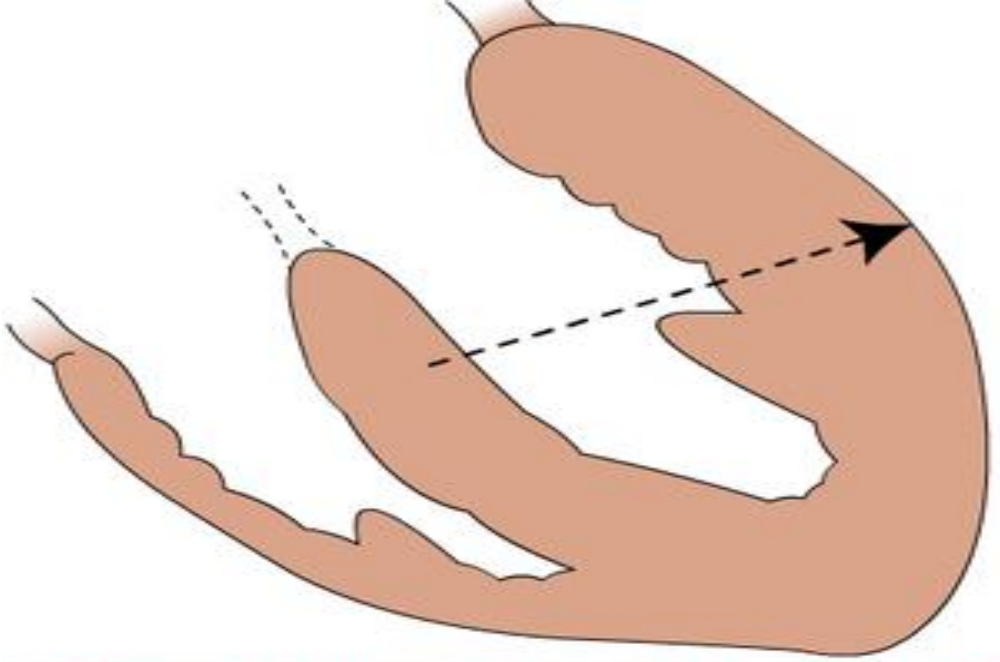
Diagnostic assessment

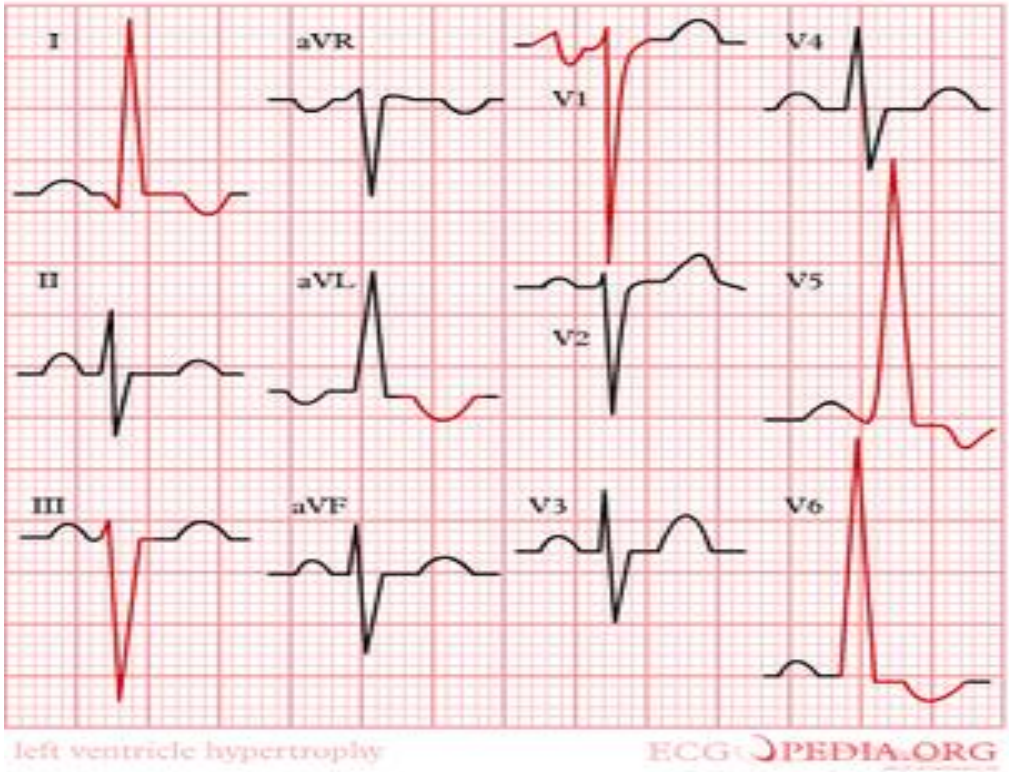
ECG – in each patient with possibility of HF

Common abnormalities in ECG in patietnts with HF:

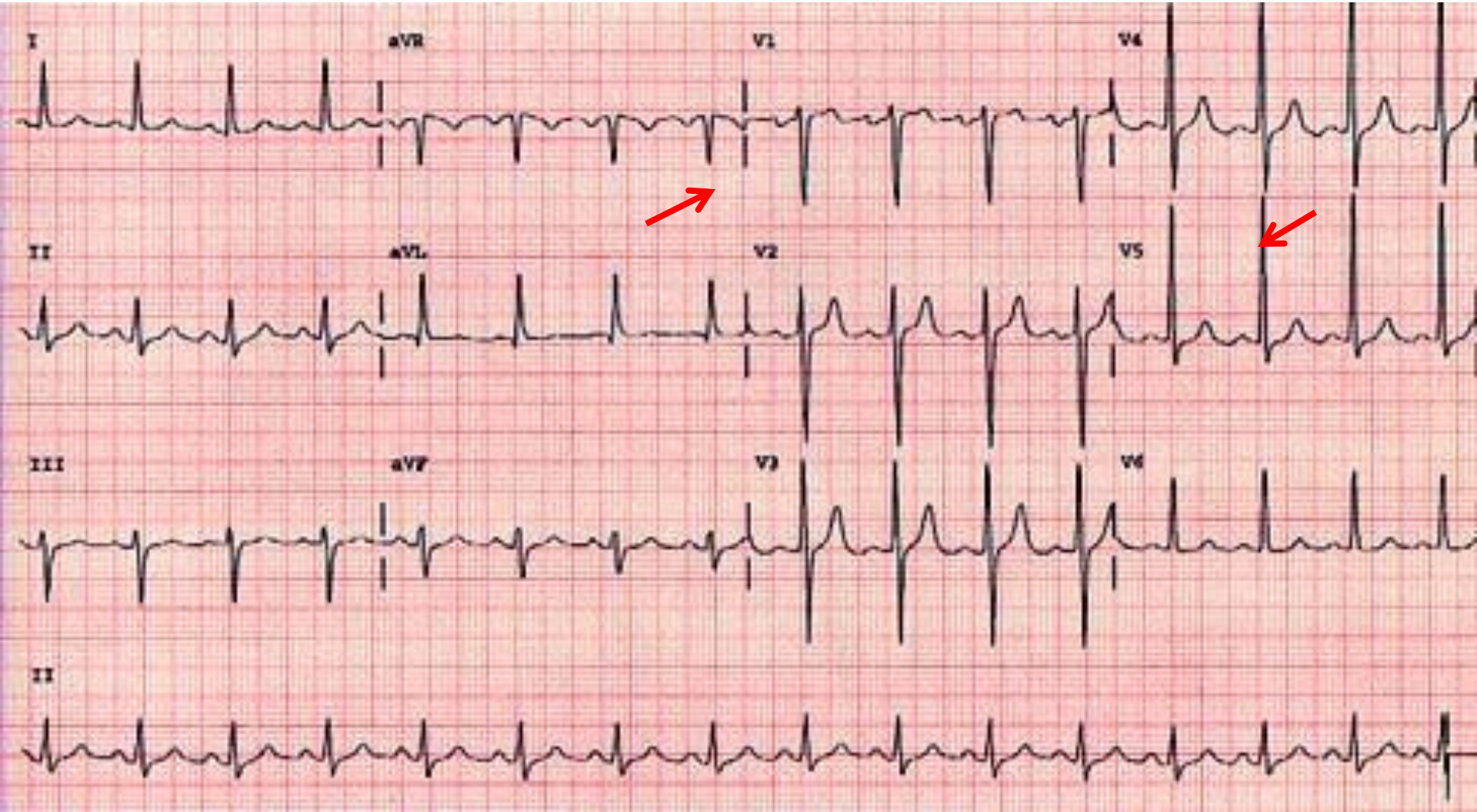
- Sinus tachycardia
- Sinus bradycardia
- Atrial tachycardia/atrial fibrillation/atrial flutter
- Ventricular arrhythmias
- Ischemia/myocardial infarction
- Q wave
- Signs of left ventricular hypertrophy

ECG – LV hypertrophy

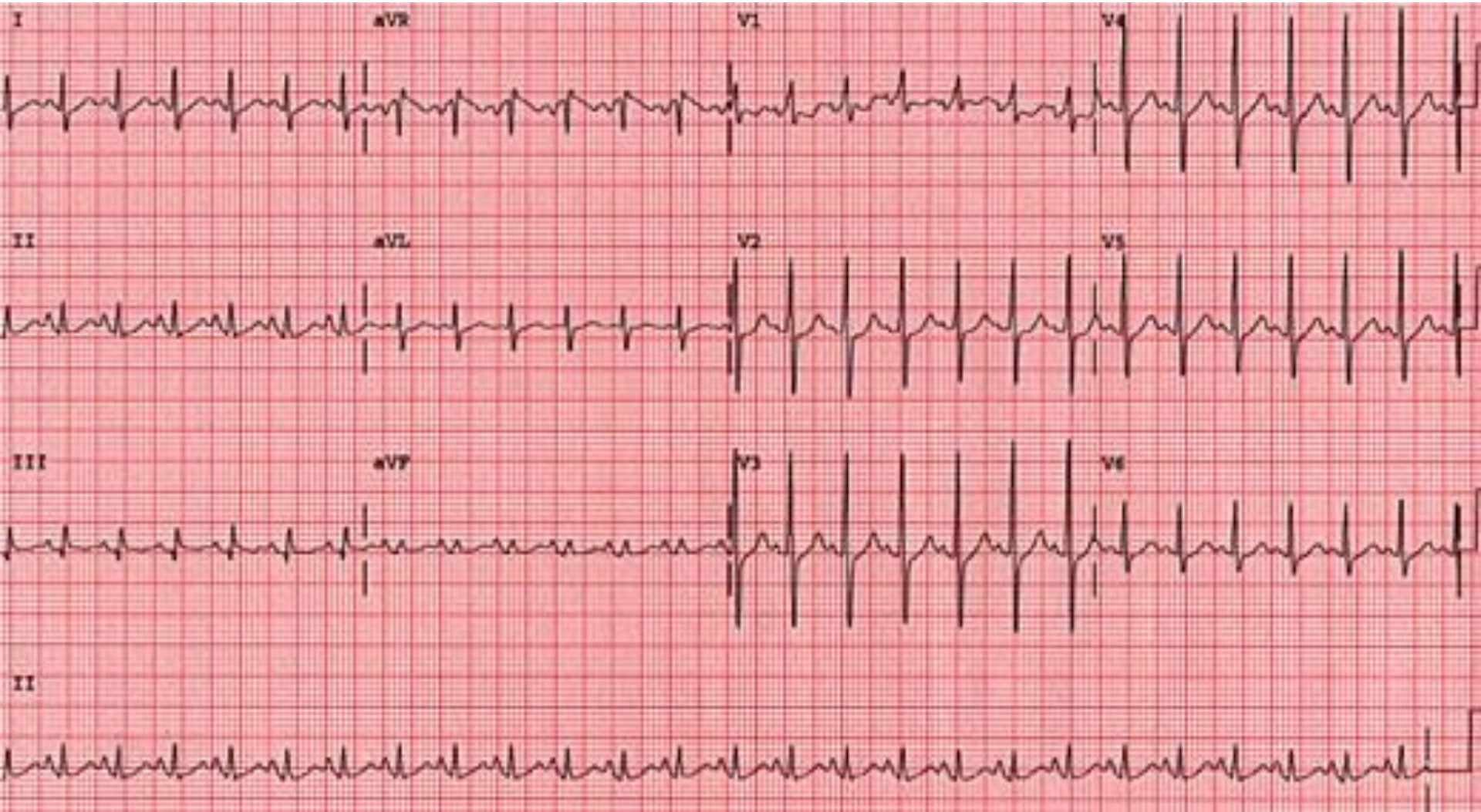




ECG – LV hypertrophy



ECG – LV hypertrophy

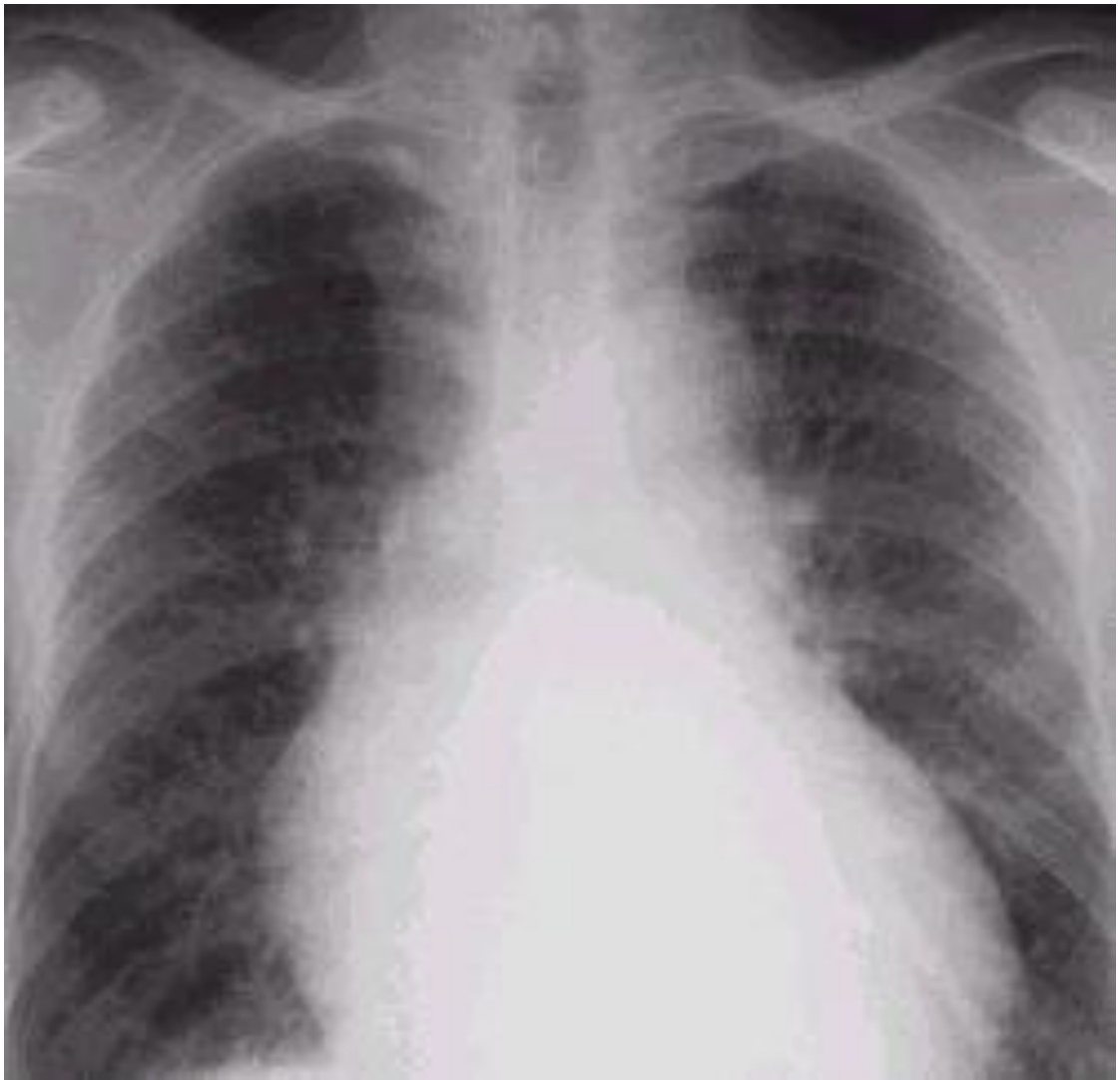


Diagnostic assessment

Chest X-ray

- Cardiomegaly
- Pulmonary congestion
- Hydrothorax
- Possible pulmonary disorders/infection as a cause od dyspnea

Chest X-ray (cardiomegaly)



Diagnostic assessment

- Laboratory:
  - Complete blood count – CBC (anemia)
  - electrolytes (hyponatremia, hypokalemia)
  - creatinine (chronic renal disease in patient with CHF)
  - Glucose blood level
  - Enzymes (AlT and AST)
  - Urine test

Biochemic markers

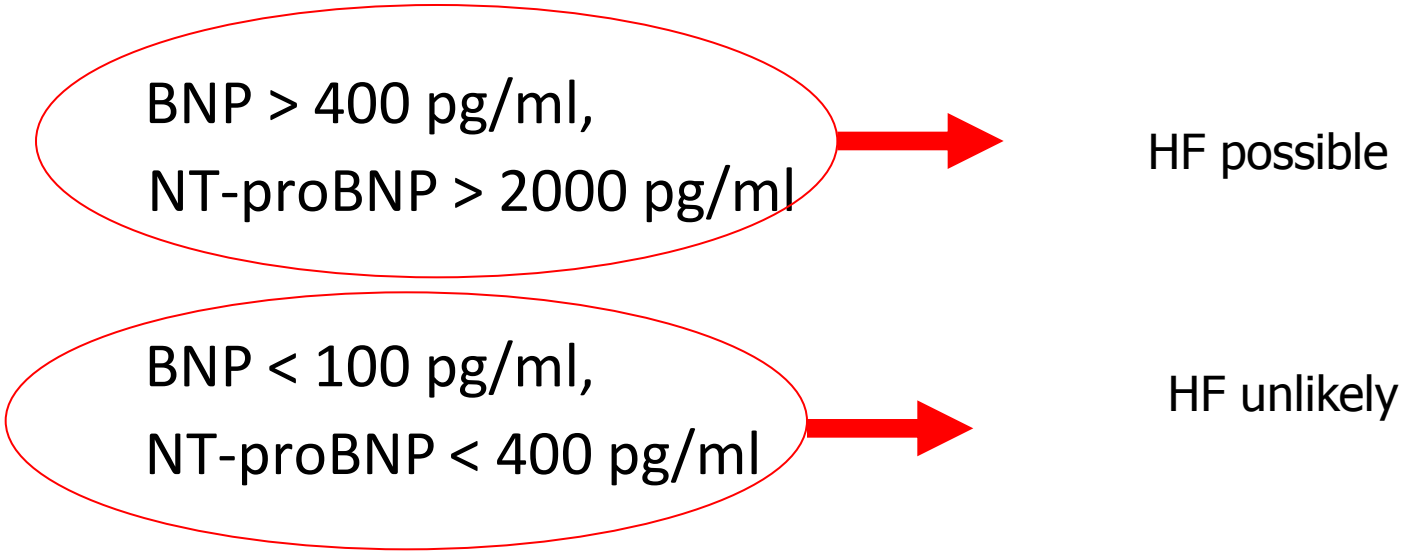
Natriuretic peptides

- BNP – natriuretic peptide type B (brain natriuretic peptide)
- NT-proBNP - N-terminal pro-B-type natriuretic peptide

Serum l evels of natriuretic peptides rise in HF because of increased heart wall tension.

Natriuretic peptides role

- Diagnosis of HF
- Prognostic parameter
- Treatment efficacy monitoring



Diagnostic assessment

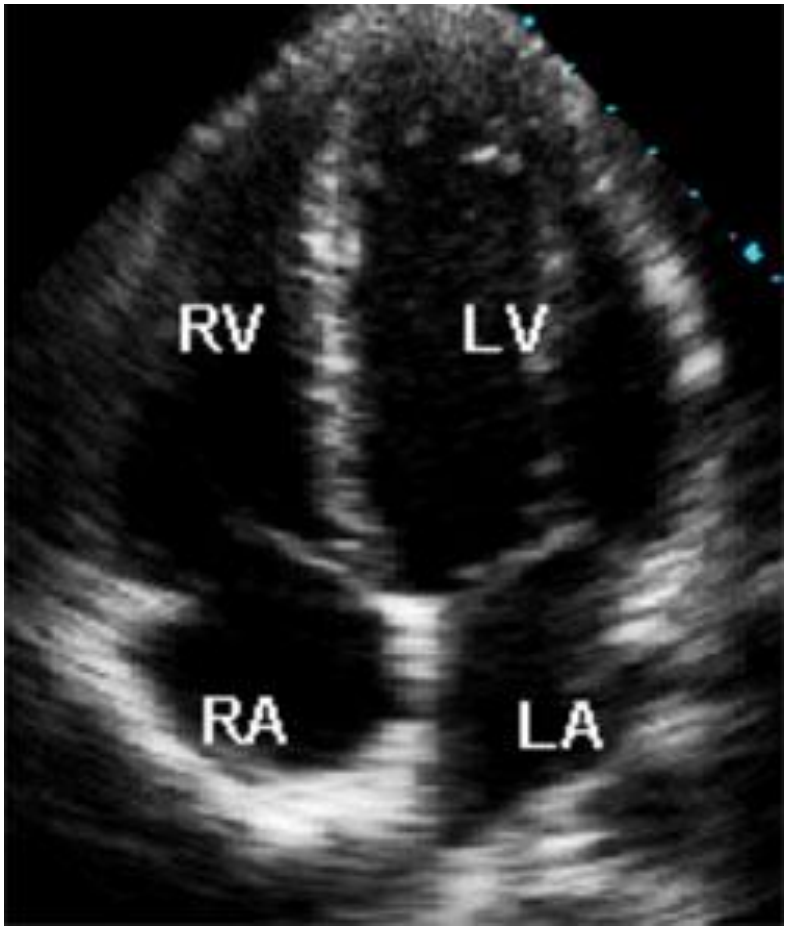
- Troponin levels (I or T)
  - Useful when HF may be related to acute coronary syndrome
  - Slightly elevated in CHF, especially with decompensation of the disease
  - Elevated – important prognostic factor

Diagnostic assessment

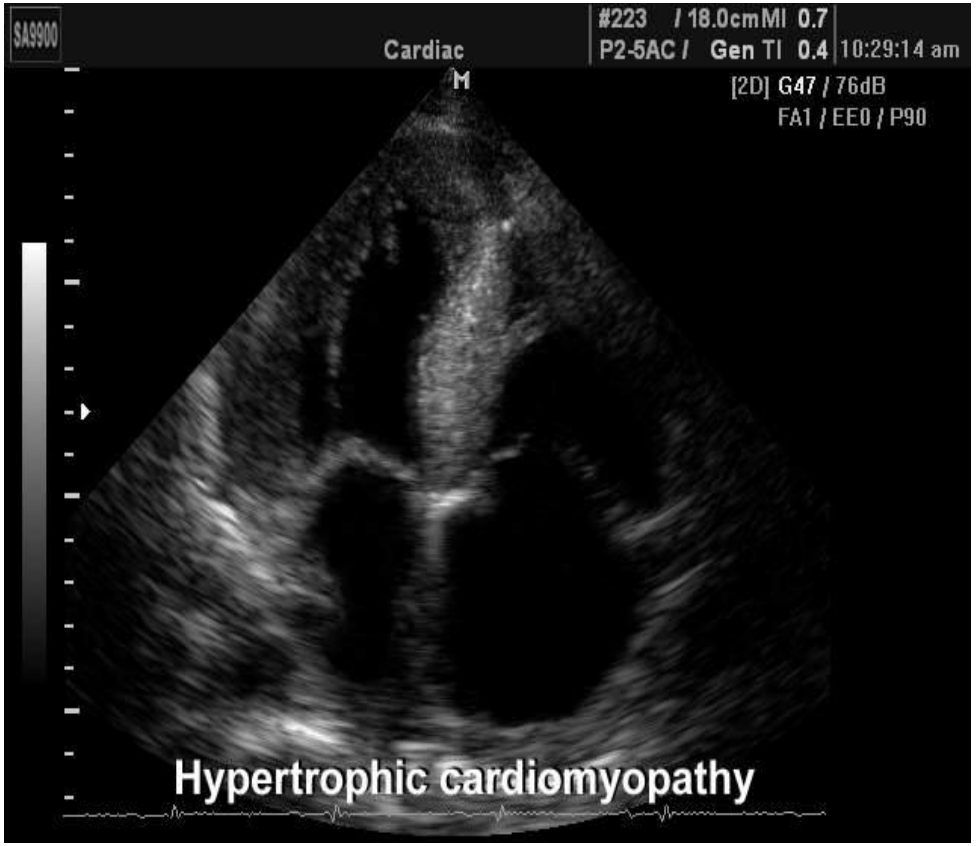
- Echocardiography
  - Used to evaluate heart dysfunction at rest
  - Evaluation of chambers size and pressures, wall thikness, contractility, valves function, and pulmonary artery pressure
  - LVEF (left ventricle ejection fraction) – the most important parameters in defining impaired left ventricular systolic function

Echocardiography

Physiological echo



Hypertrophy of the interventricular septum



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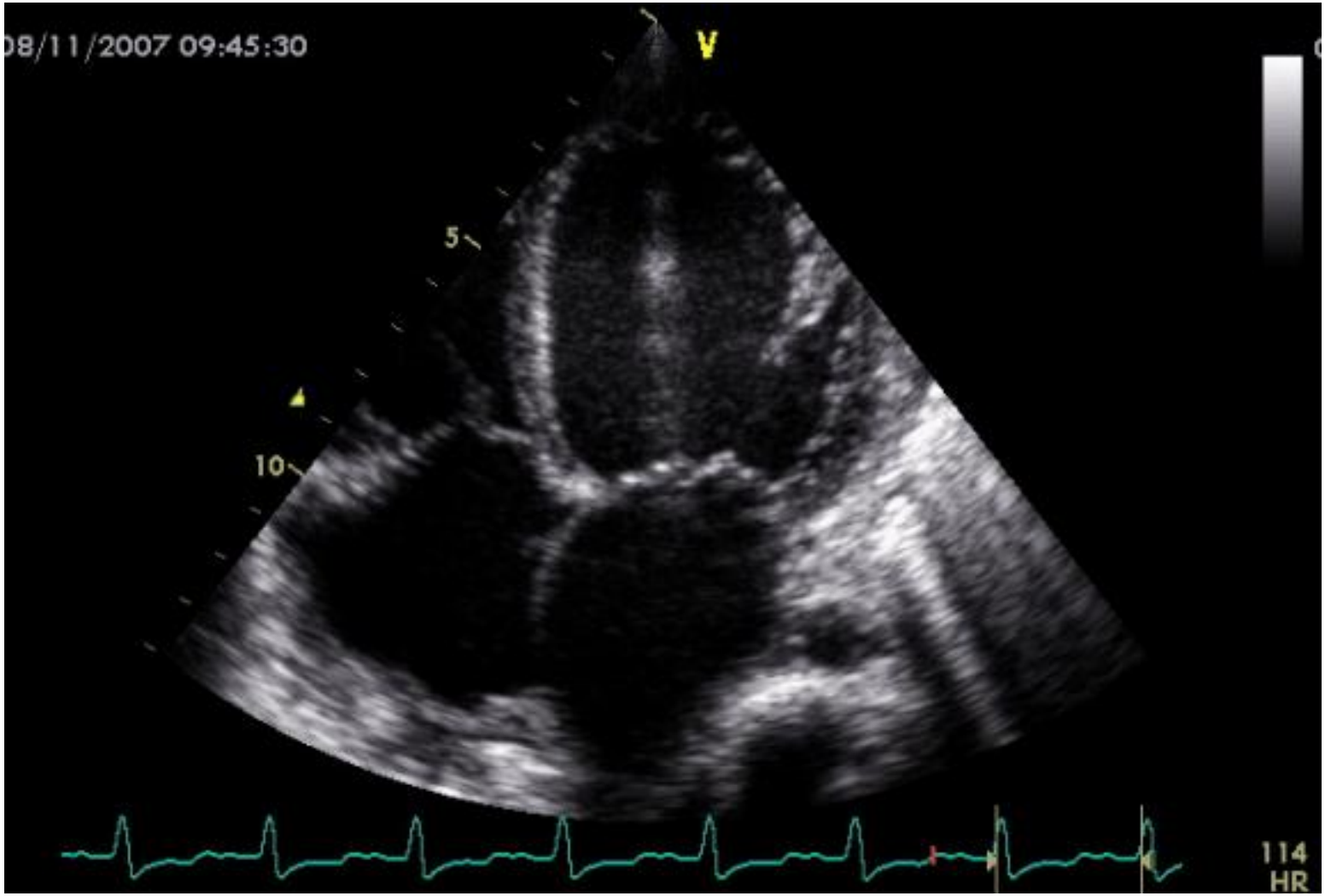


Diagnostic assessment

- Holter monitoring
  - In patients with symptoms suggesting arrhythmias (syncope, palpitations)
  - May reveal frequency and duration of arrhythmia and also silent episodes of ischemia

Diagnostic assessment

Cardiopulmonary exercise test (CPET)

- cardiopulmonary exercise testing is a non-invasive and objective method of evaluating both cardiac and pulmonary function
- Involves measurements of respiratory oxygen uptake (VO2), carbon dioxide production (VCO2) and ventilatory parameters during a symptom-limited exercise
- Important measurements include: ECG, systemic blood pressure and ventilatory parameters as VO2, VCO2, minute ventilation (VE)
- Under steady-state conditions, VO2 and VCO2 measured at the mouth are equivalent of total-body oxygen consumption and carbon dioxide production

Cardiopulmonary exercise test (CPET)

Diagnostic assessment

- Transthoracic echocardiogram
- Transesophageal echocardiogram
- Coronary catheterization
- Right heart catheterization
- Endomyocardial biopsy

Treatment of HF

- Treatment - objectives:
  - Treatment of disease which leads to HF
  - Prophylaxis and management of conditions leading to worsening of the disease
  - Moderate sodium restriction along with daily weight measurement
  - Improvement of exercise tolerance
  - Delay of left ventricle remodeling
  - Prevention of sudden cardiac death and risk of death of HF progression

Non-pharmacologic management

- Sodium restriction to 2 g/d and fluid intake to 1,5-2,0 l/d
- Body mass reduction in patients with obesity
- Patient with malnutrition – nutrition improvement
- Daily weight measurement
- Alcohol intake limitation
- Stop smoking

Non-pharmacologic management

- Avoid drugs that can excerbate the HF
  - Nonsteroidal anti-inflammatory drugs, corticosteroids, antiarrhythmic agents class I, tricyclic antidepressants, calcium channel blockers, alfa – 1 blockers, biguanides)
- Every year vaccination against influenza and pneumococcal disease
- Physical training (rehabilitation)

Pharmacologic management

- Diuretics
- ACE-I (Angiotensin converting enzyme inhibitors) i ARB (angiotensin receptor blocker)
- Beta-blockers
- Aldosteron receptor blockers
- Digitalis

Diuretics

- Dyspnea and edema reduction related with water retention
- At the begining of treatment loop diuretic or thiazides
- During diuretic therapy sodium, potassium and creatine monitoring is necessary
- Examples:
  - Loop : furosemide (Furosemidum), torasemide (Diuver)
  - Thiazides: hydrochlorotiazide (Hydrochlotothiazidum)

ACE - inhibitors

- ACE inhibitions in patients with left ventricular systolic dysfunction independently of the presence of symptoms
- significant reduction in mortality as well as alleviation of symptoms and improvement in clinical status
- In patients with MI (myocardial infarction) reduction of reinfarction risk
- Caution: may lead to renal function deterioration, hyperkalemia, symptomatic hypotension, cough and rarely angioedema

ACE - inhibitors

- ACE-I examples:
  - Ramipril (Tritace, Piramil, Axtil, Polpril)
  - Cilazapril (Inhibace, Cilan)
  - Peryndopril (Prestarium, Prenessa)
  - Enalapril (Enarenal, Enap)
  - Kaptopril (Captopril)
  - Lizynopril (Lisiprol, Lisinoratio)
  - Chinapril (Accupro, Acurenal)

Angiotensin receptor blocker(ARB)

- Recommended in patients with HF with maintained symptoms despite of optimal treatment with ACE-I and β-blockers (if no aldosteron receptor blockers use)
- In patients with side-effects while taking ACE-I (most commonly cough)
- Examples: candesartan (Atacand),
  valsartan (Diovan),
  losartan (Xartan, Lorista),
  telmisartan (Micardis)

B-blockers

- In all patients with symptomatic HF and LVEF<40%
- Beta-blockers can slow the progression of systolic forms of heart failure and decrease the heart leading to better patient comfort
- significant reduction in hospitalization rate of HF deterioriation and increased survival rates
- Examples:

  -bisoprolol (Bisocard, Concor Cor)

  -metoprolol CR (Betaloc, Beto ZK, Metocard)

  -carwedilol (Vivacor, Carvedilol)

  -nebivolol (Nebilet, Ebivol)

Aldosteron receptor blockers

Antagonizes following action of aldosterone by mineralocorticoid receptors such as:

- Sodium resorption in the collecting duct of the nephron in the kidneys and water retention
- Potassium and magnesium urine loss
- Myocardial remodeling (fibrosis)

Examples:

-spironolactone (Spironol, Verospiron)

-eplerenone (Inspra)

Digitalis

- First choice in patients with HF and AF and AFL and accelerated heart rate
- Patients with HF and sinus rhythm and NYHA class III
- Most commonly digitalis

Invasive treatment

- Electrotherapy
  - Cardiac resynchronization therapy (CRT)
  - Implantable Cardioverter Defibrillator (ICD)
- Coronary angioplasty
- Left Ventricular Assist Devices
- Cardiac surgery (cardiac transplantation)

Cardiac resynchronization therapy

Cardiac resynchronization therapy (CRT)

- In approximately 30% of patients with heart failure, an abnormality in the heart's electrical conducting system (called an "intraventricular conduction delay") causes the two ventricles to beat in an asynchronous fashion. That is, instead of beating simultaneously, the two ventricles beat slightly out of phase

Cardiac resynchronization teraphy

Cardiac resynchronization therapy (CRT)

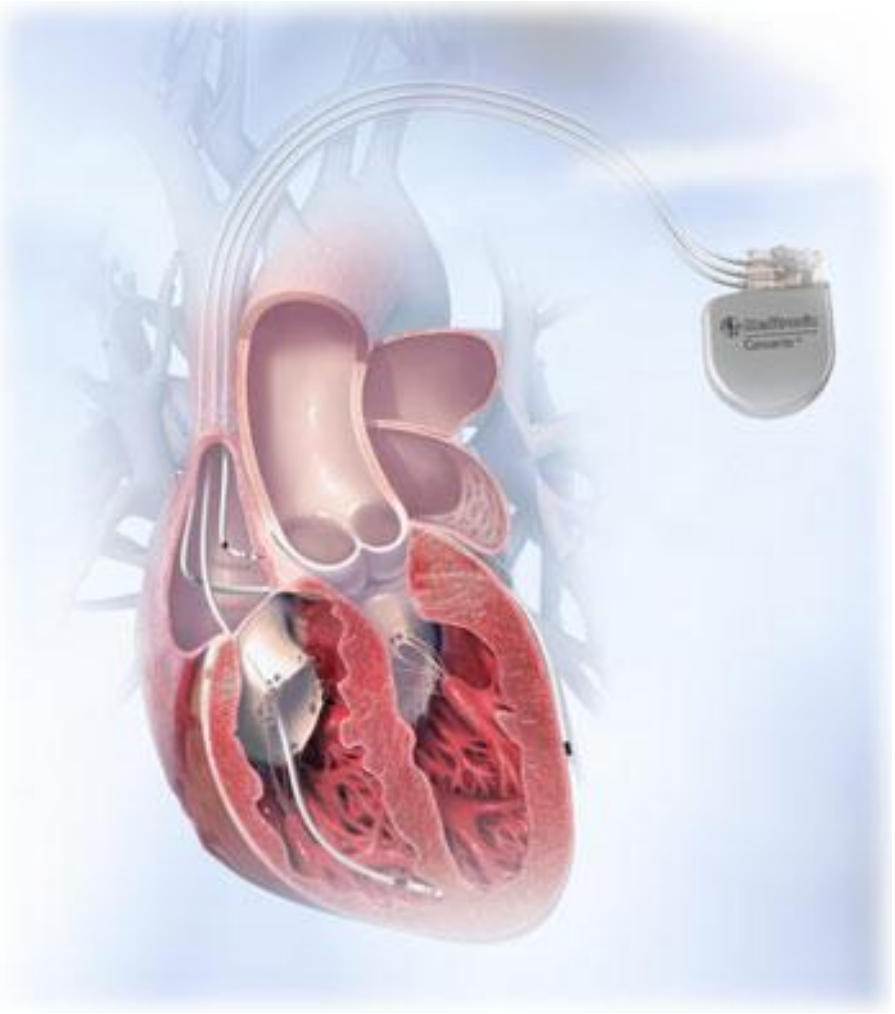
- CRT typically have 3 electrodes (or leads), one in the right atrium and one in the right ventricle, which permit the pacemaker to maintain the normal coordinated pumping relationship between top and bottom of the heart; the third lead that is positioned in a vein on the outer surface of the left ventricle (this allows the CRT pacemaker to simultaneously stimulate the left and right ventricles and restore a coordinated, or synchronous, pumping action)

Resynchronization

Heart without CRT

Heart with CRT

CRT



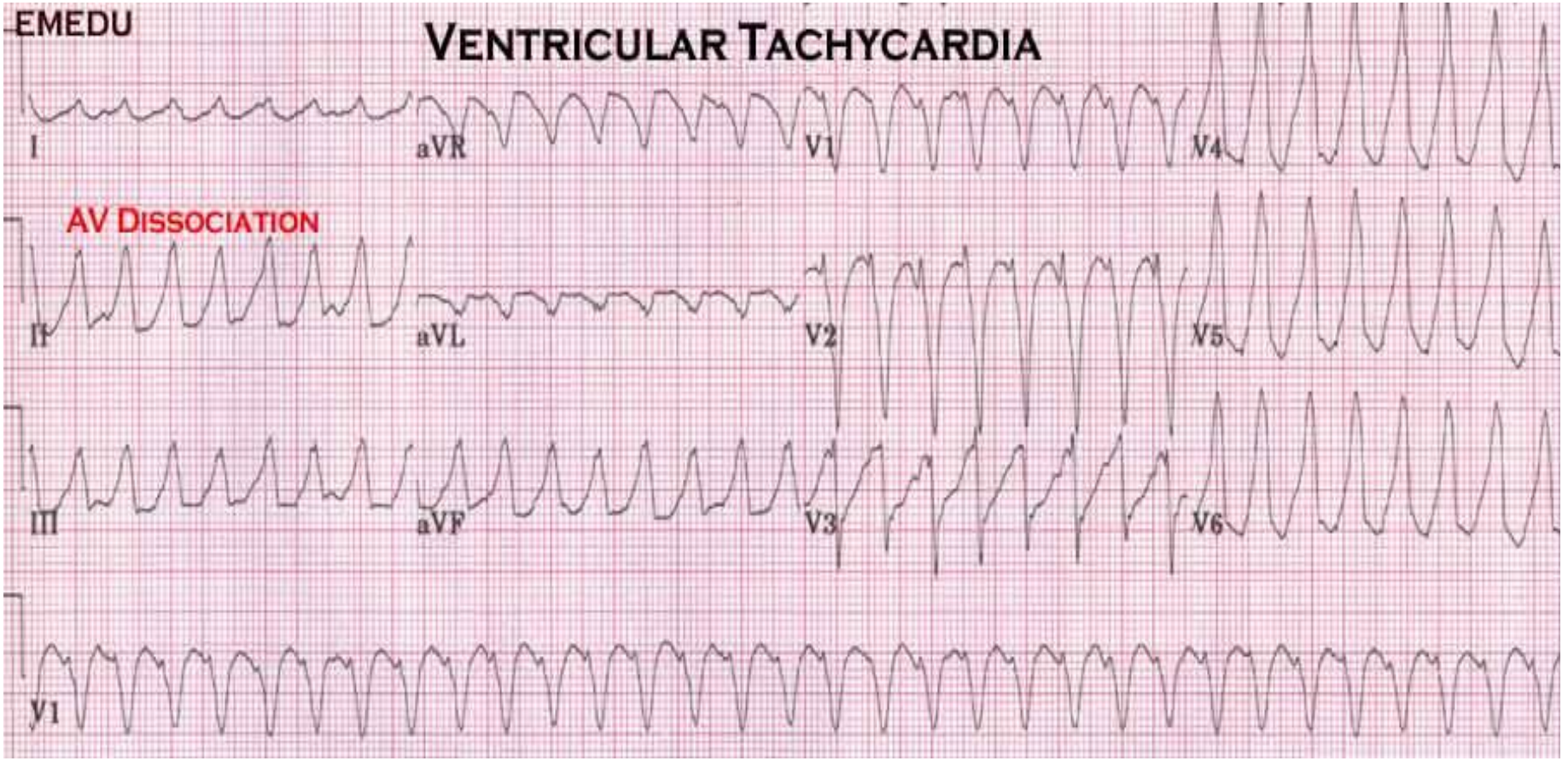
- CRT improves:
  - Heart function as a pump
  - Exercise tolerance
  - Quality of life

CRT

Implantable Cardioverter Defibrillator (ICD)

- An ICD uses electrical pulses or shocks to help control life-threatening arrhythmias, especially those that can cause sudden cardiac arrest (SCA)
- In HF population almost 50% of deaths is due to a sudden cardiac arrest
- Indication for ICD implantation:
  - past cardiac arrest (ventricular fibrillation –VF)
  - sustained hemodynamically unstable ventricular tachycardia (VT) or VT with syncope
  - postinfarction ventricular dysfunction – primary prevention

ECG – ventricular tachycardia



Heart transplantation

- Accepted therapy for the treatment of end-stage congestive heart failure
- Have not been helped by conventional medical therapy and are excluded from other surgical options
- Candidacy determination and evaluation are key components of the process, as is postoperative follow-up care and immunosuppression management