ECG in modern medicine:

“Yesterday”
or
“Forever young”?

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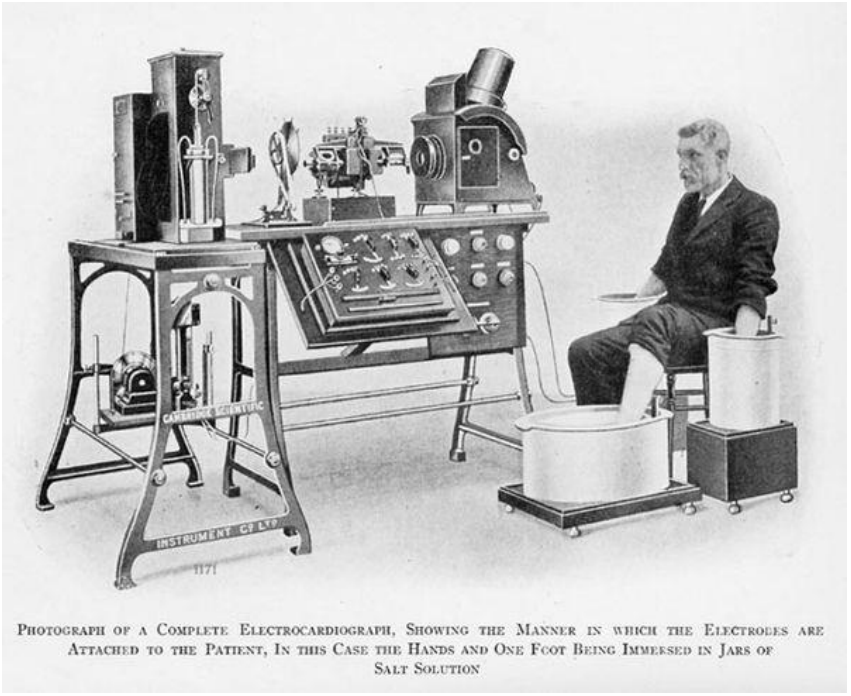
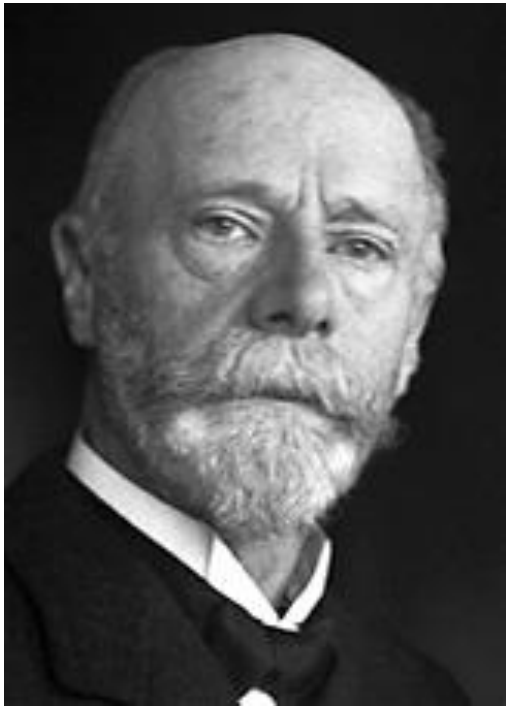
27th European School of Internal Medicine (ESIM)
Riga (Latvia), 10 February, 2017

ECG: anamnesis vitae

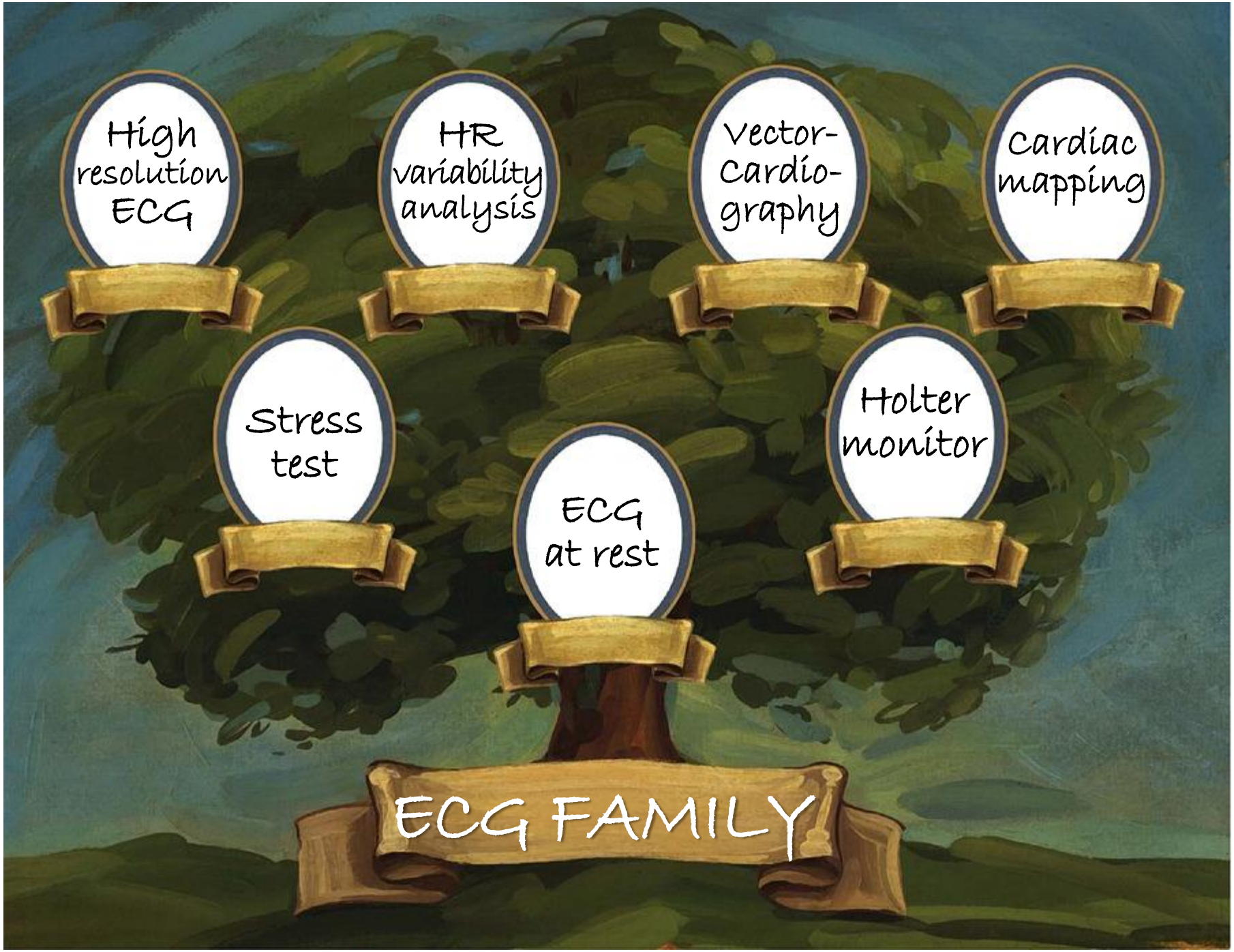
Augustus Waller
(1856-1922)



PHOTOGRAPH OF A COMPLETE ELECTROCARDIOGRAPH, SHOWING THE MANNER IN WHICH THE ELECTRODES ARE ATTACHED TO THE PATIENT, IN THIS CASE THE HANDS AND ONE FOOT BEING IMMERSED IN JARS OF SALT SOLUTION



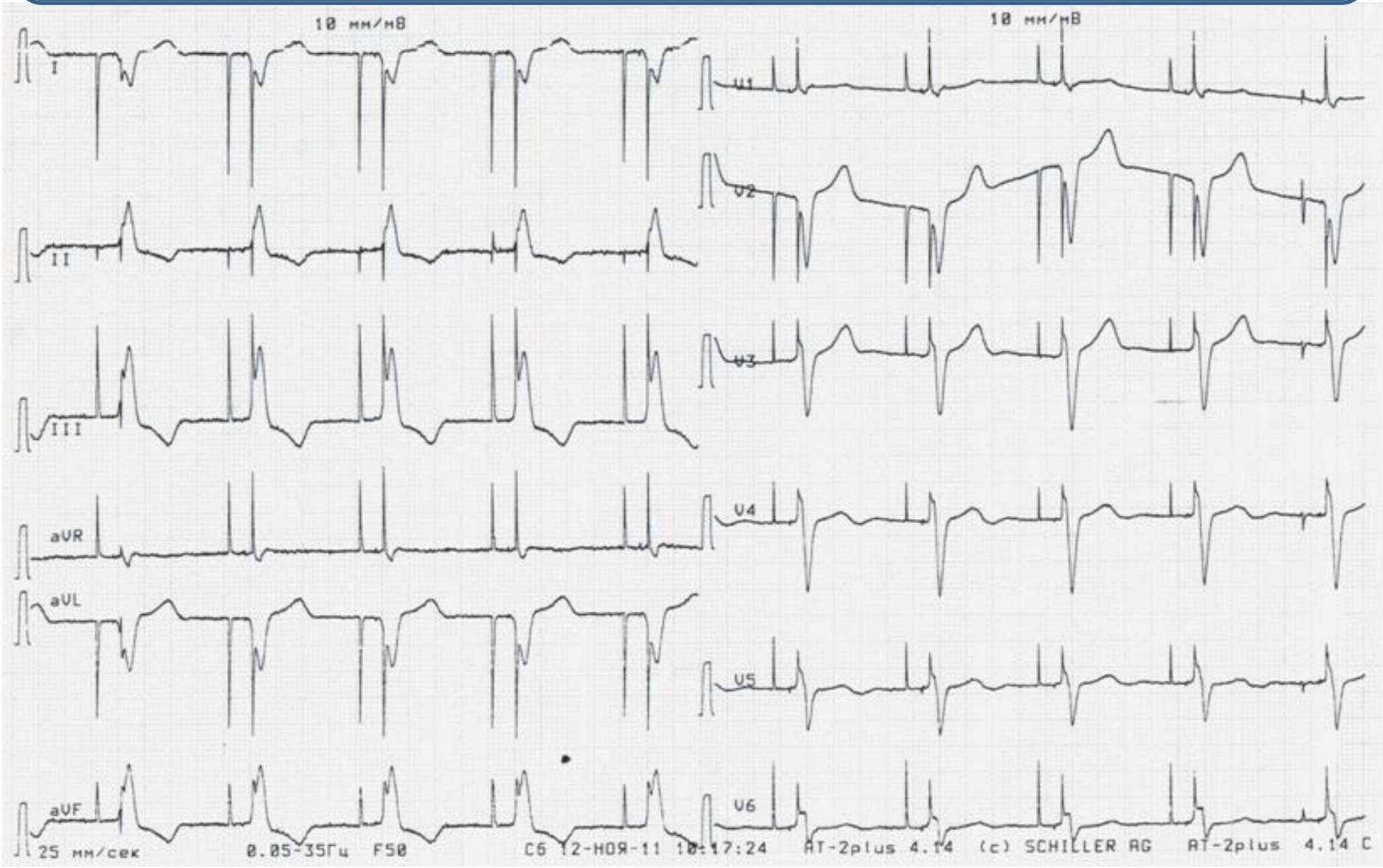
Willem Einthoven
(1860-1927)


High resolution ECG
HR variability analysis
Vector-cardio-graphy
Cardiac mapping
Stress test
ECG at rest
Holter monitor
ECG FAMILY

Stage 1. Trainee

A. Supraventricular tachycardia
B. Ventricular tachycardia
C. Atrial fibrillation
D. Ventricular fibrillation

A. Atrial pacing
B. Dual chamber pacing
C. Ventricular pacing
D. Multi chamber pacing



Artificial pacemakers

- One chamber (atrial or ventricular), dual chamber, multi chamber (biventricular)
- Temporary or permanent
- The most common regimens of pacing:

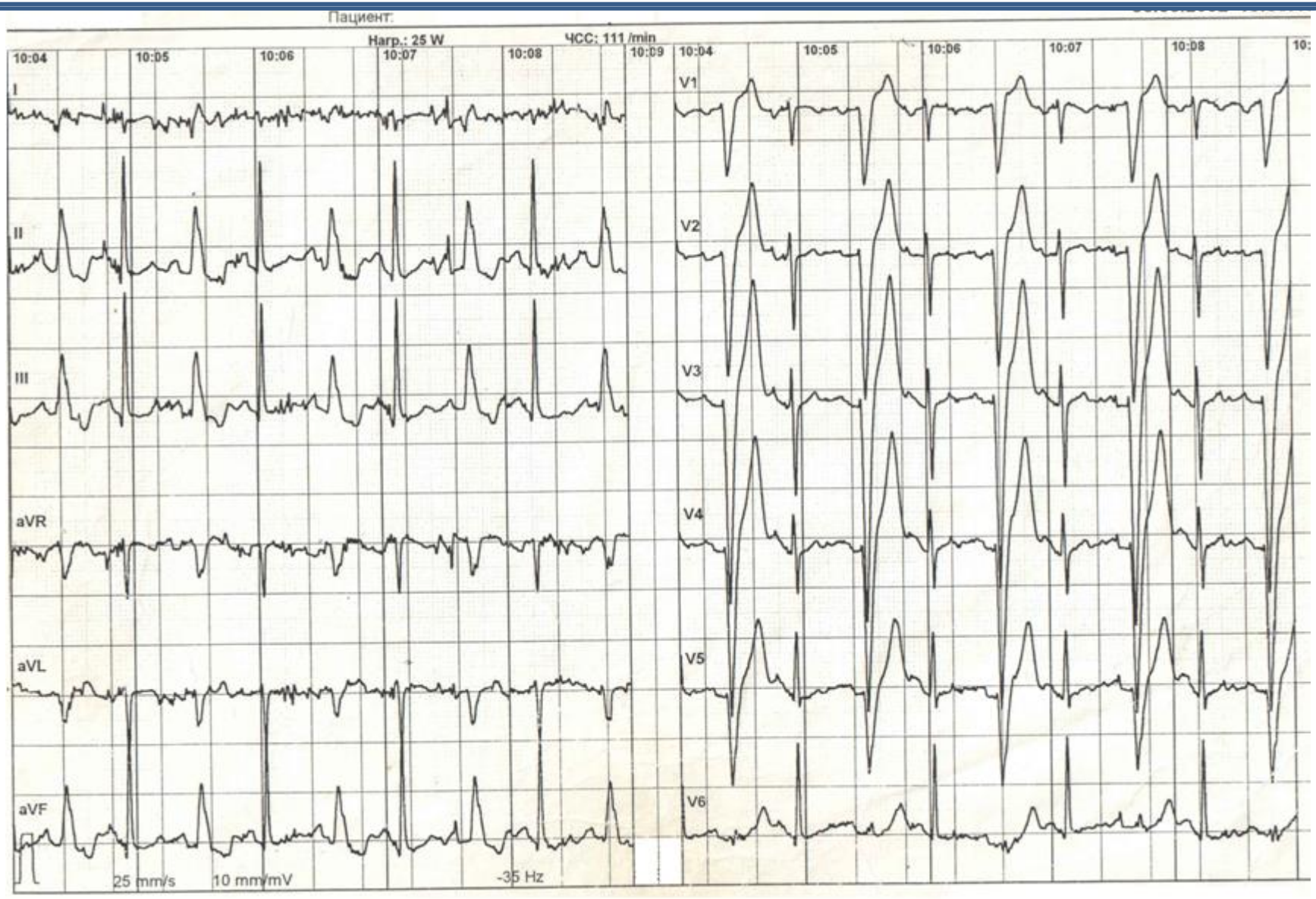
  VVI — one chamber ventricular pacing on demand;

  VVIR — the same but with rate adaptation;

  AAI — one chamber atrial pacing on demand;

  DDD — dual chambers atrial-ventricular biocontrolled pacing
- *Cardiac resynchronizing therapy* (CRT) – in patient with heart failure and signs of dyssynchrony on Echo

A. **Transient LBBB**
B. Ventricular extrasystoles
C. Supraventricular extrasystoles
D. Transient WPW syndrome



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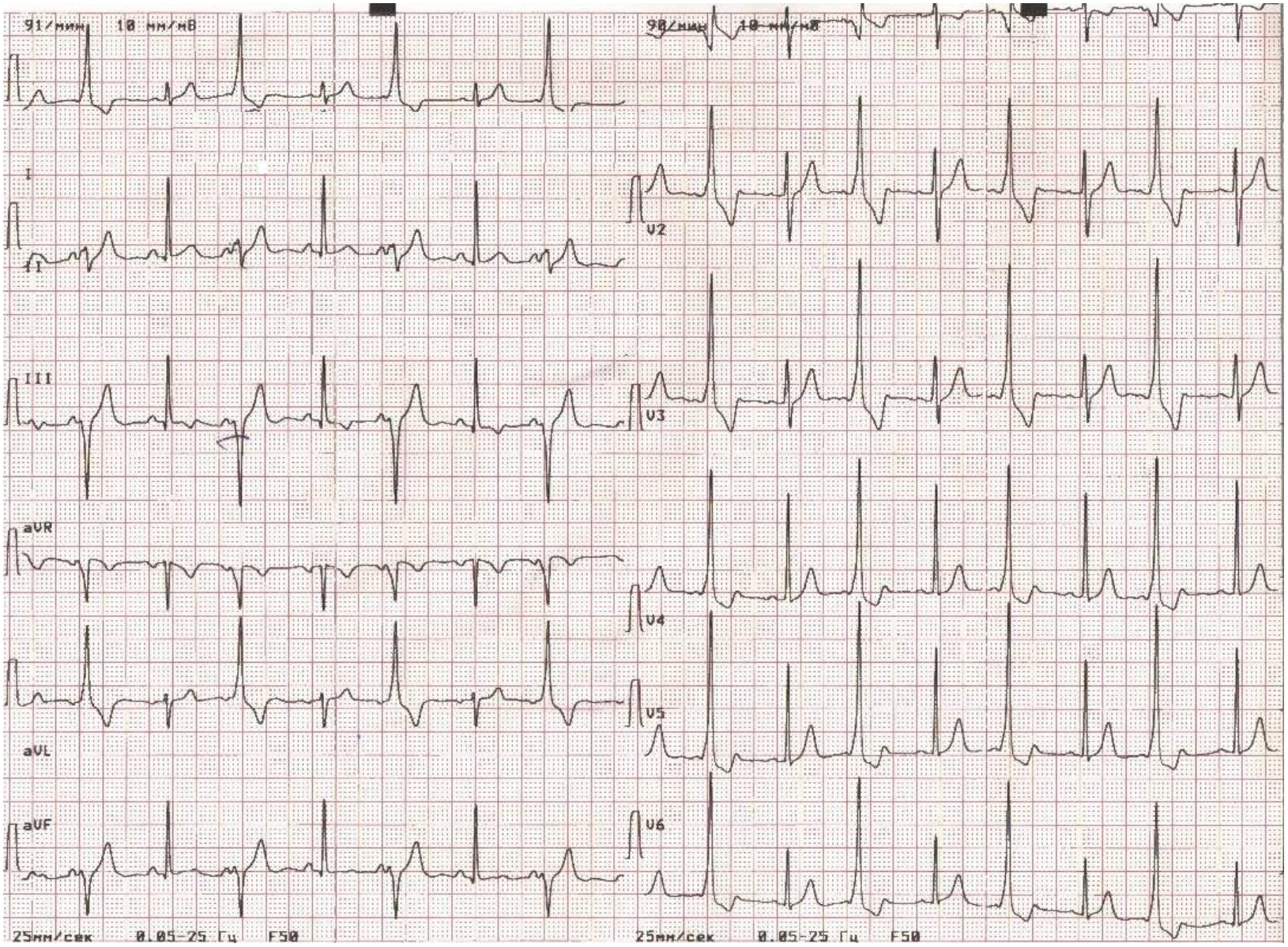
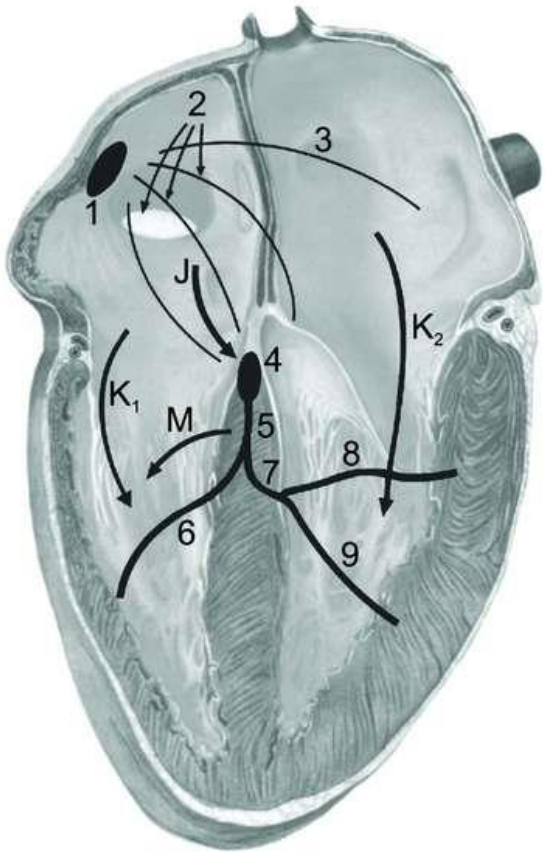


Ventricular pre-excitation syndromes



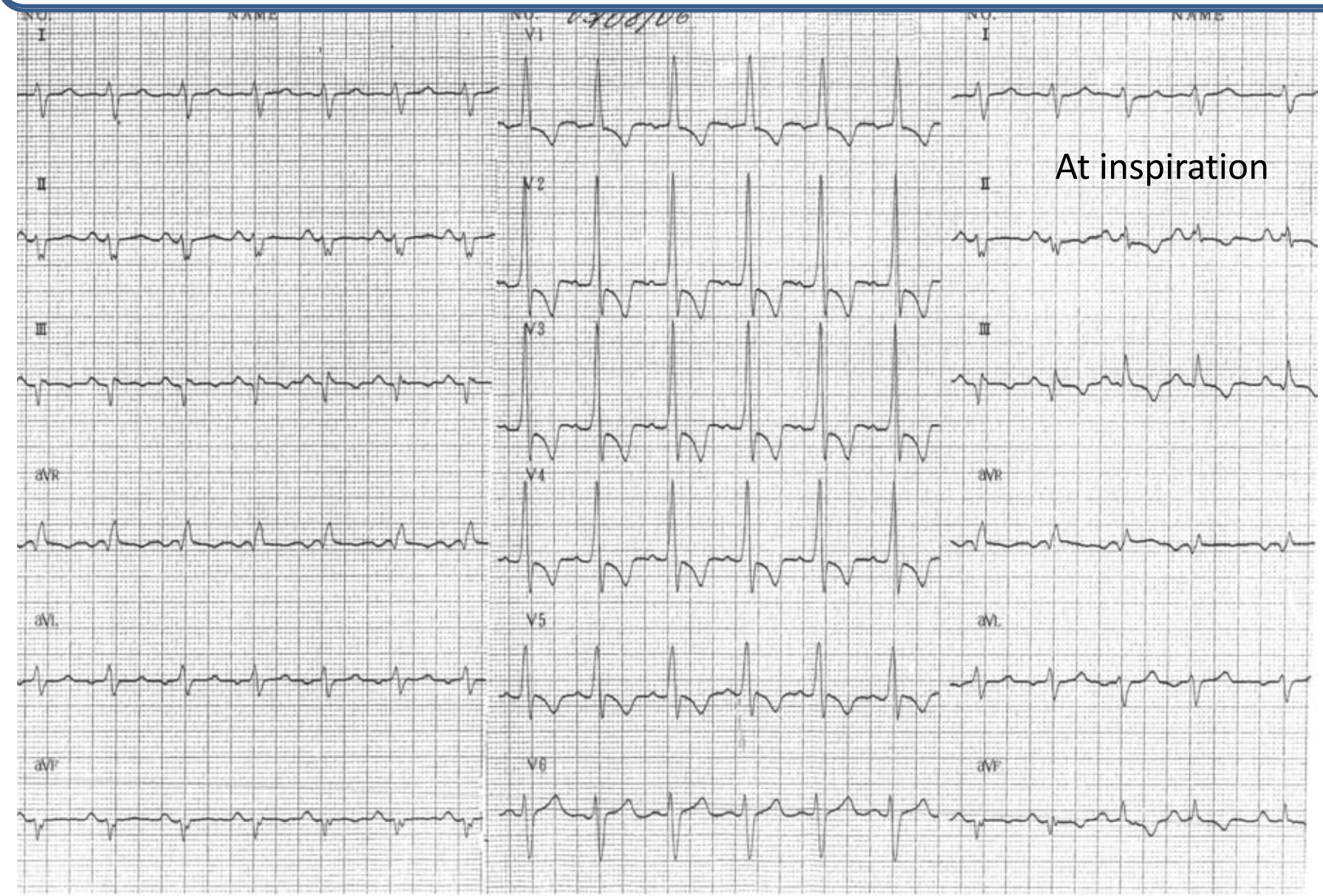
- Wolf-Parkinson-White (WPW) syndrome (phenomenon) – short PQ interval (< 120 ms), appearance of delta wave, wide, deformed QRS complex (> 120 ms), secondary changes of ST segment and T wave;
- Lown–Ganong–Levine syndrome (LGL) - short PQ interval (< 110 ms) with normal QRS complex, absence of delta wave and without ST segment and T wave changes;
- Mahaim type – normal duration of PQ interval with presence of delta wave

A. Inferior STEMI

B. WPW syndrome

C. Acute cor pulmonale

D. Dextrocardia



Acute cor pulmonale

Main reasons:

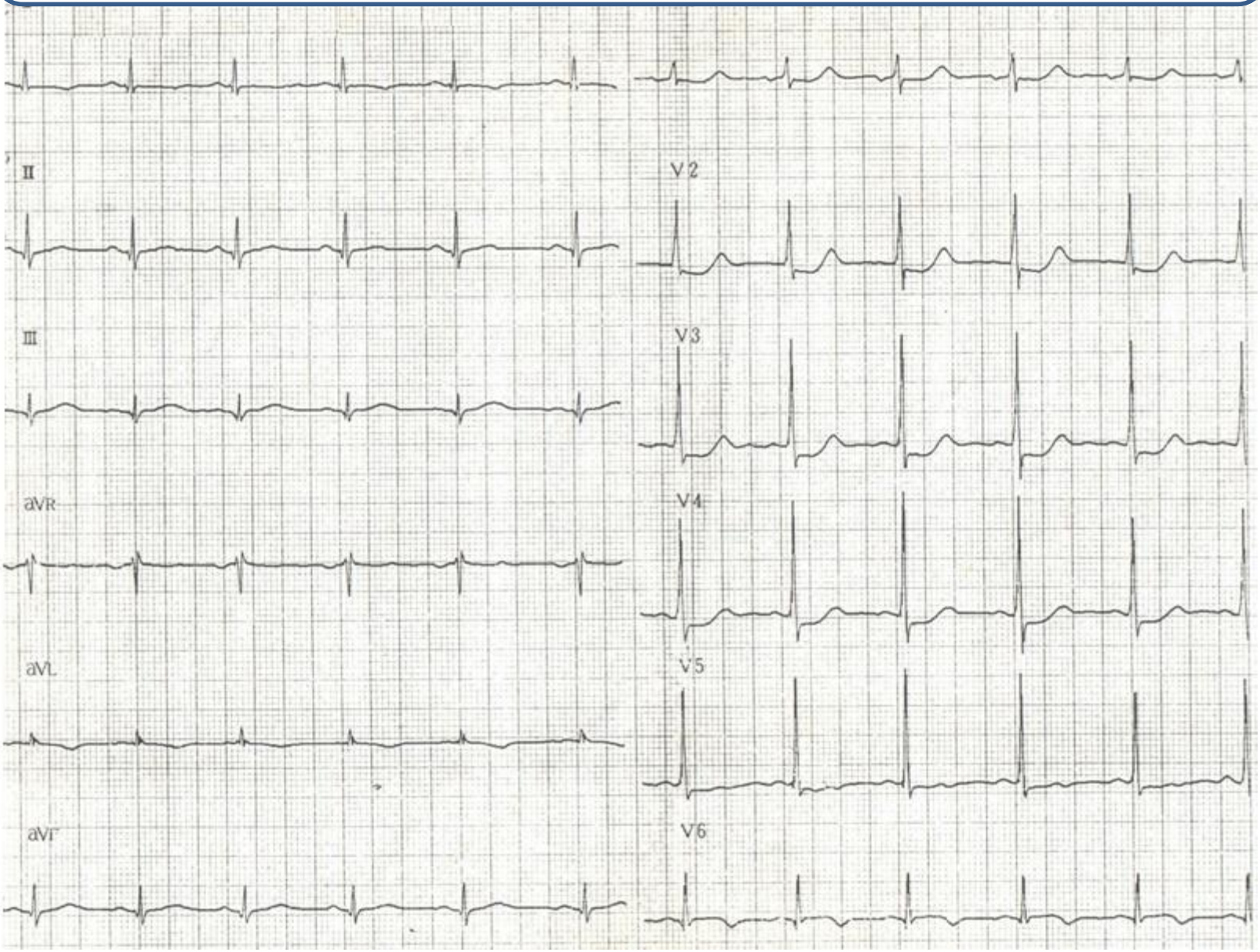
- Pulmonary embolism (*not only thrombotic origin!*)
- Pneumothorax
- Status asthmaticus
- Massive pneumonia
- ARDS

ECG findings:

- ✓ P-pulmonale
- ✓ Right bundle branch block
- ✓ Deep S wave in V_5-V_6
- ✓ T wave inversion in right chest leads
- ✓ McGinn-White syndrome (deep S wave in lead I, Q wave and negative T wave in III lead – $Q_{III}S_IT_{III}$)

Stage 2. Bachelor

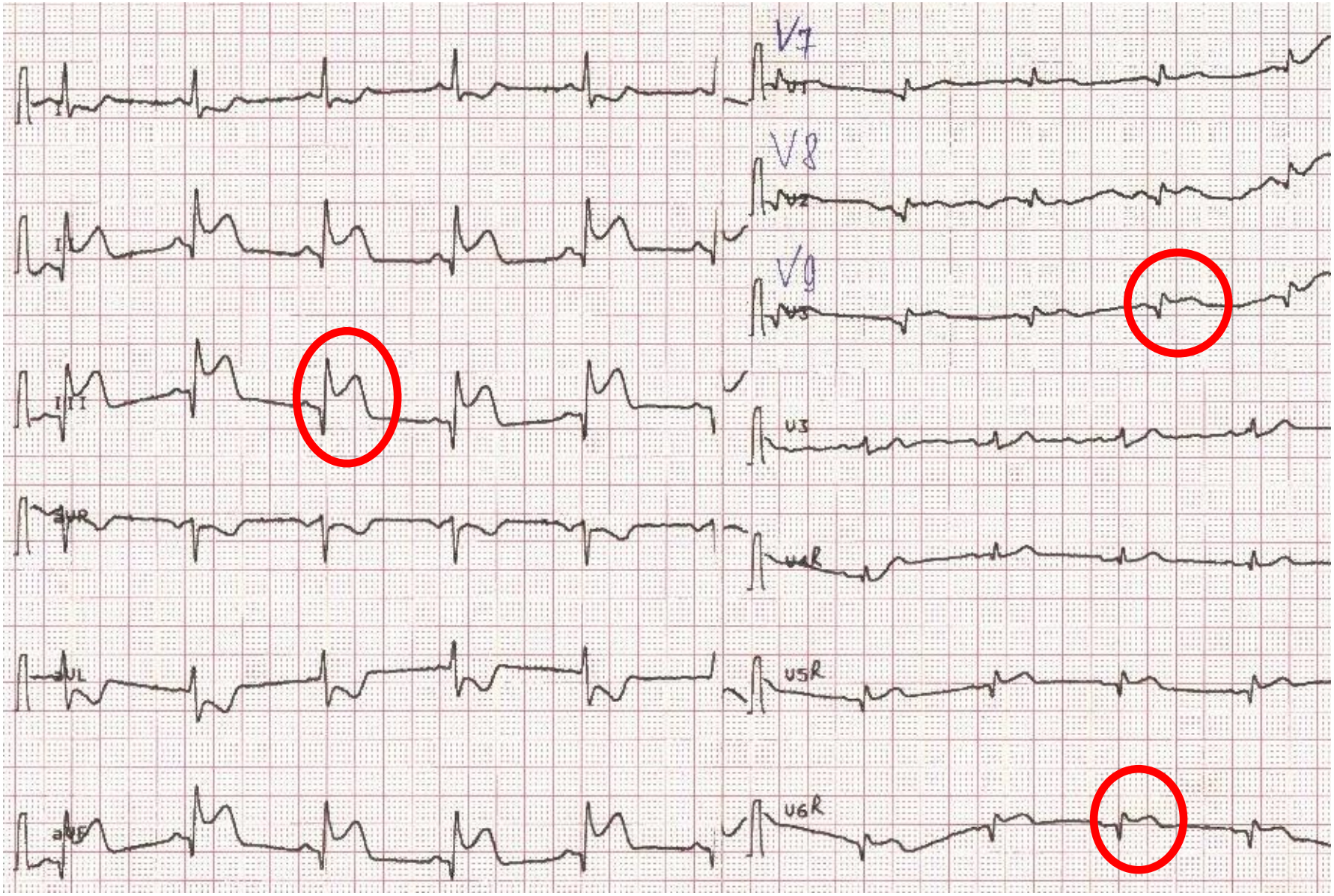
A. Normal ECG
B. Posterior STEMI
C. Anterior wall ischemia
D. WPW syndrome



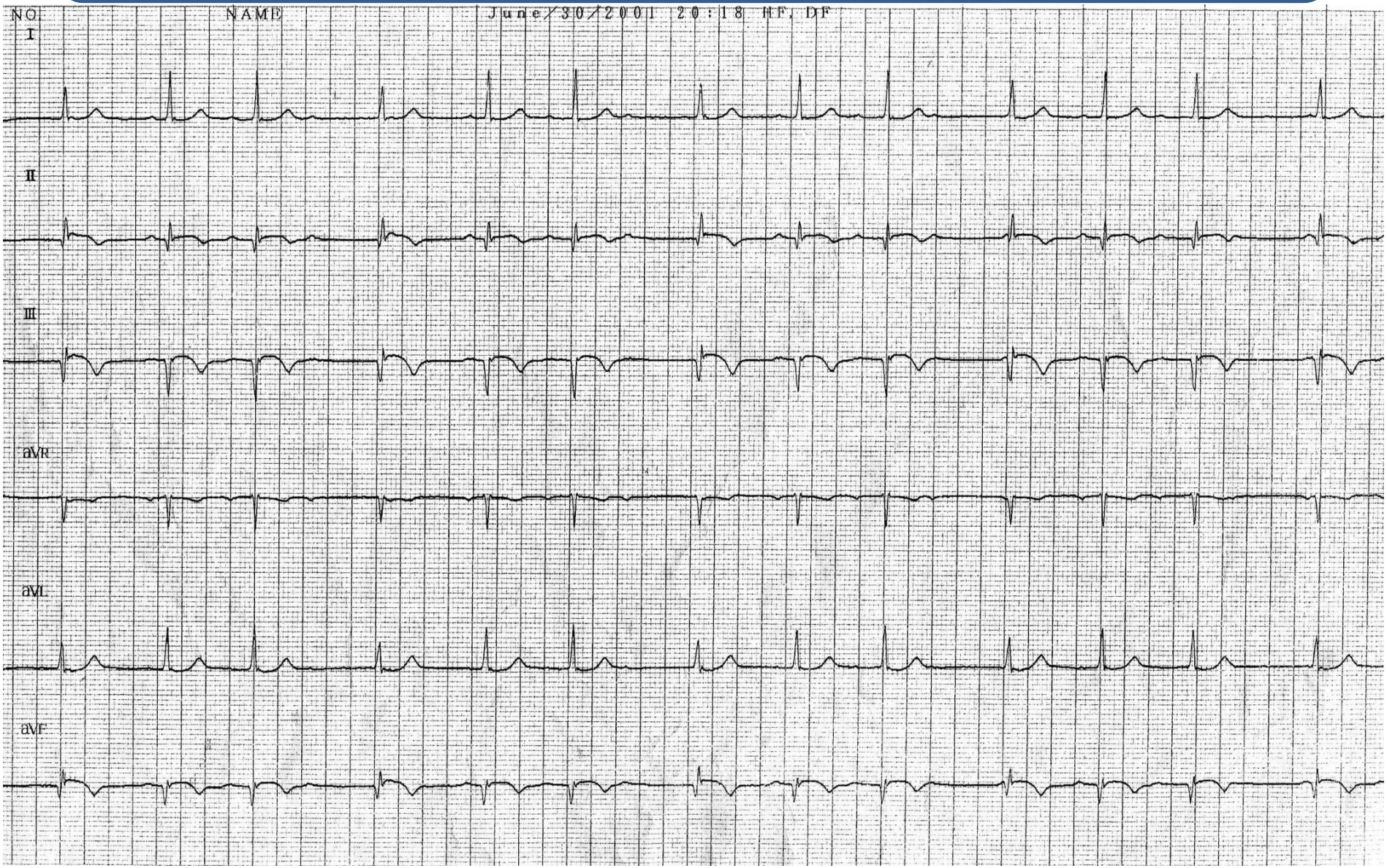
Localization of myocardial infarction

Localization	Main changes	Reciprocal changes
LV anterior wall	V_1-V_4	II, III, AVF
LV inferior wall	II, III, AVF	I, AVL, V_1-V_4
LV posterior wall	V_7-V_9	High R wave and ST depression in V_1-V_2
LV lateral wall	I, AVL, V_5-V_6	-
LV high lateral wall	AVL, V_3^2- V_6^2	-
Left main artery	AVR	I, II, AVL, AVF, V_2-V_6
Right ventricle	V_{3R}-V_{6R}	V_2, AVF
Atria	PQ segment and P wave changes	-

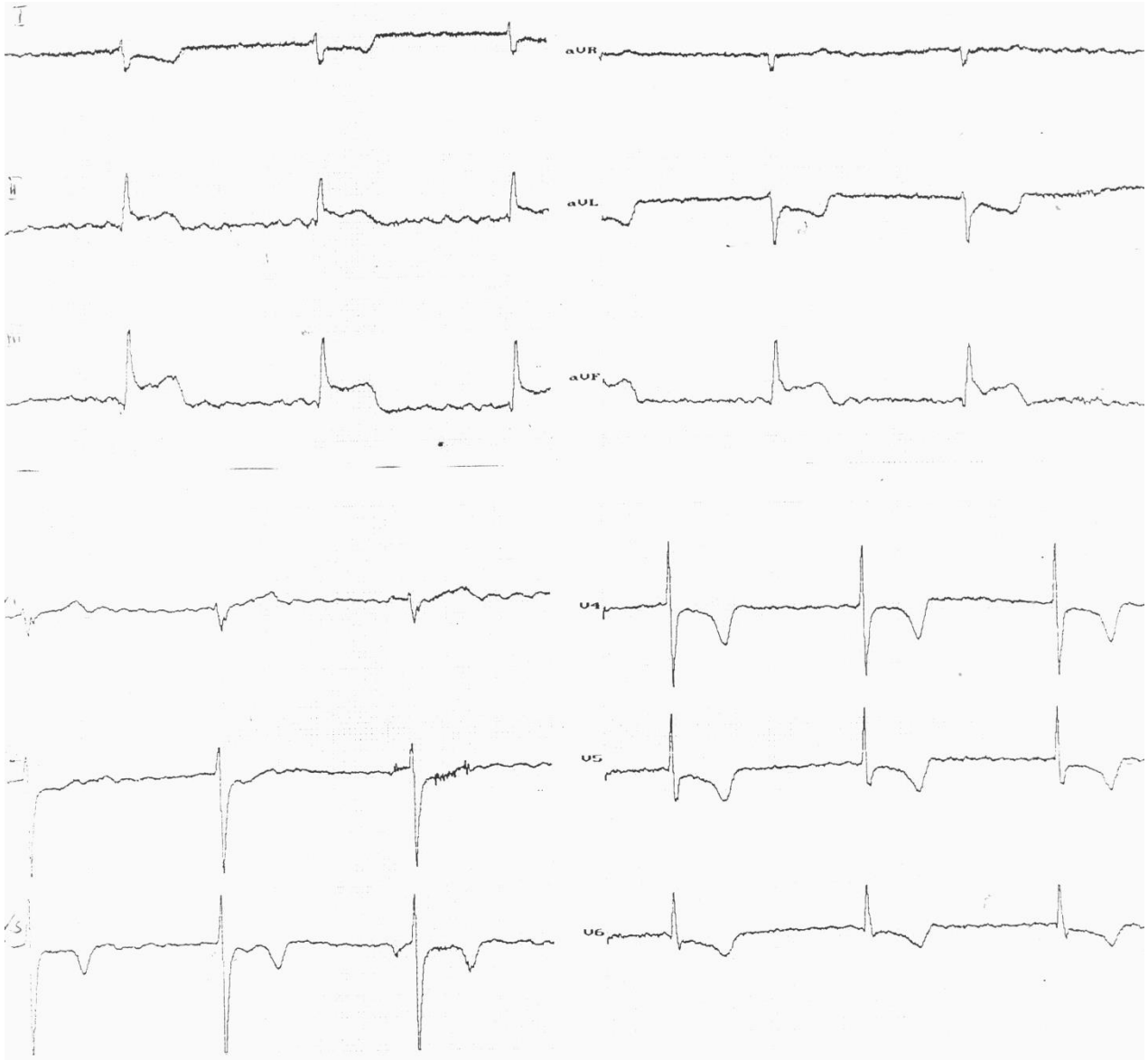
Inferior & posterior MI with RV involvement



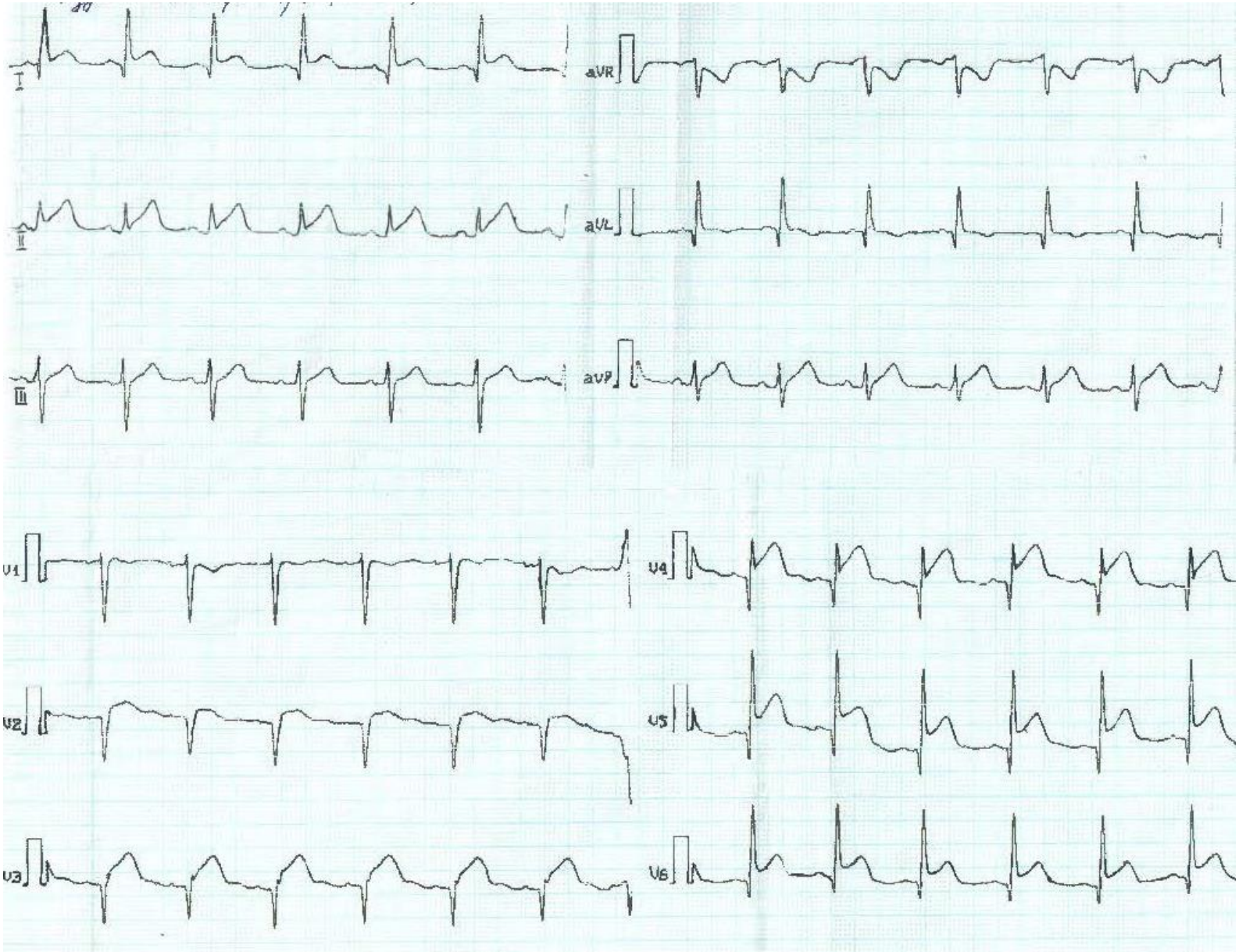
A. Atrial fibrillation
B. Sinoatrial block
C. AV-block with escape beats
D. Supraventricular extrasystoles



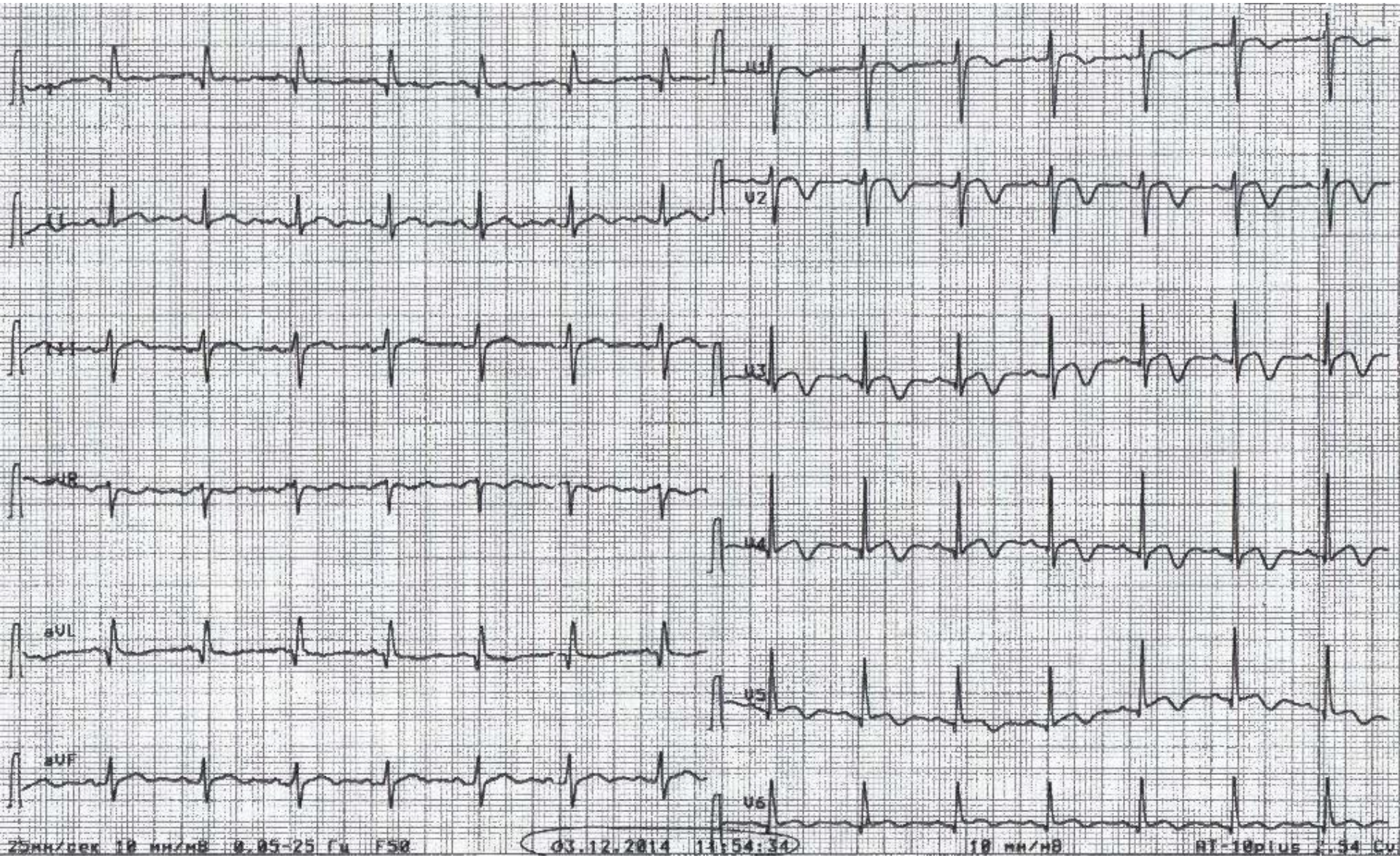
A. WPW syndrome
B. Brugada syndrome
C. Fredericq syndrome
D. Wellens syndrome



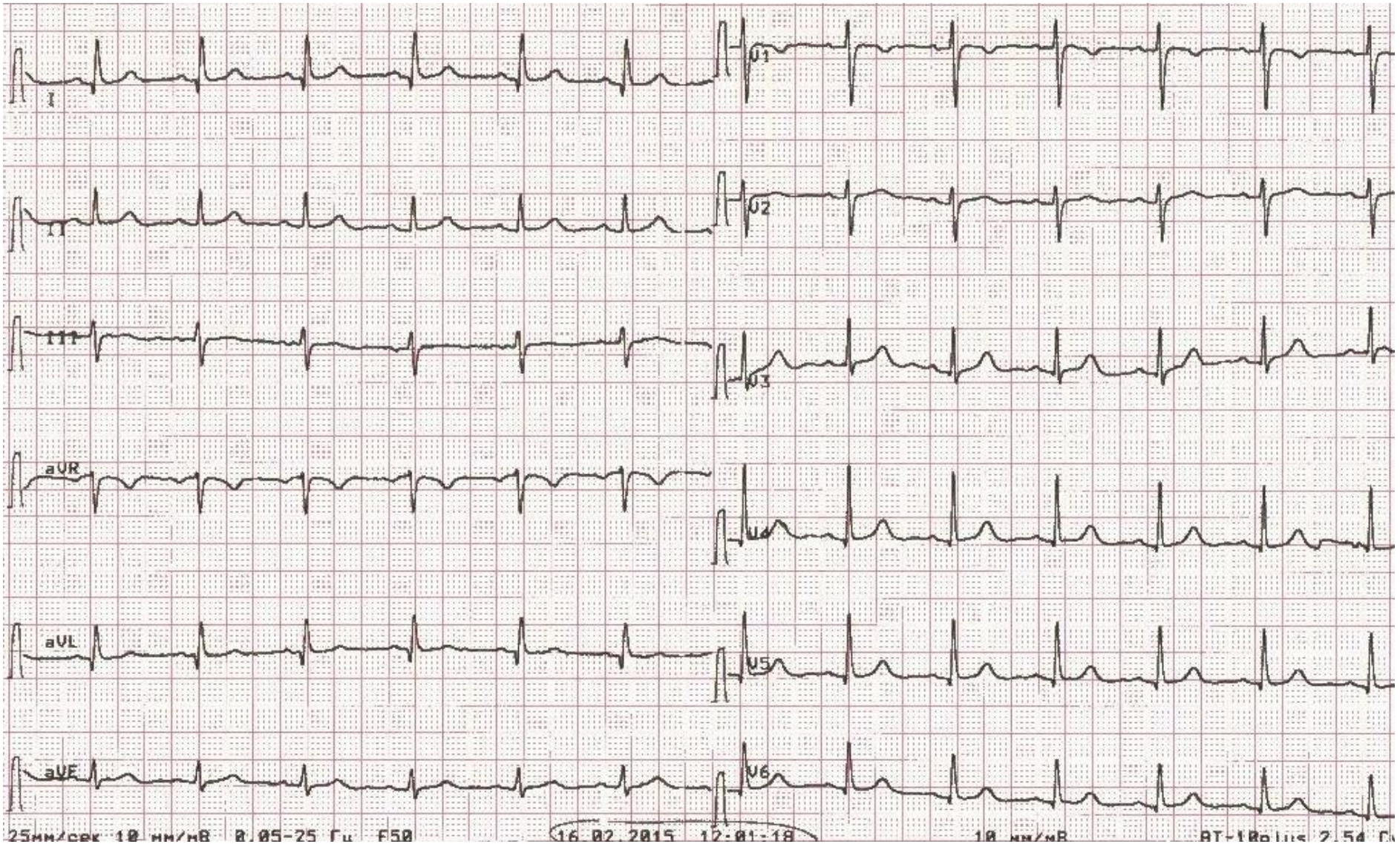
Female, 73 years old, was admitted with complaints of chest pain and dyspnea



Angiography showed absence of significant coronary stenosis, but Tn I was elevated and LV apical aneurysm with EF 28% was revealed on Echo .

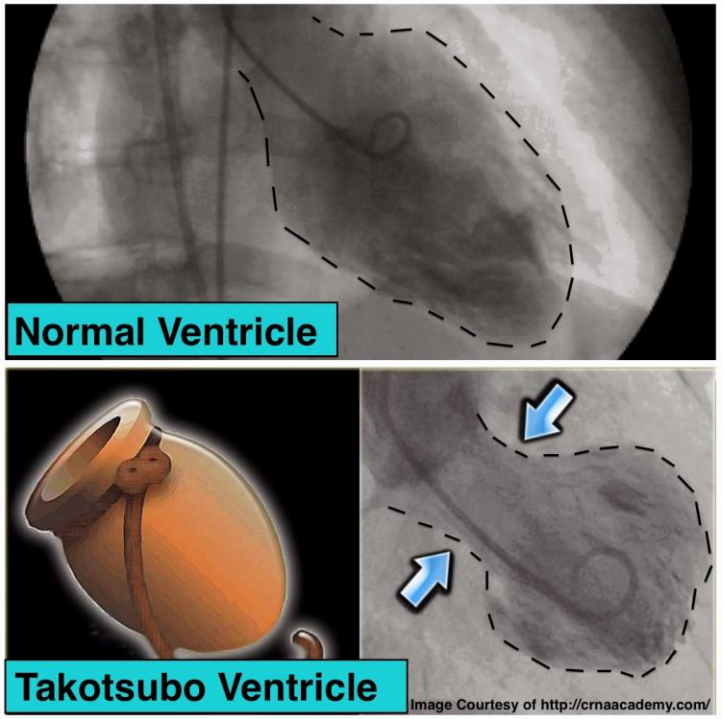


A. Hypertrophic cardiomyopathy
B. Takotsubo cardiomyopathy
C. Anterior non-Q MI
D. Prinzmetal's angina



Takotsubo cardiomyopathy

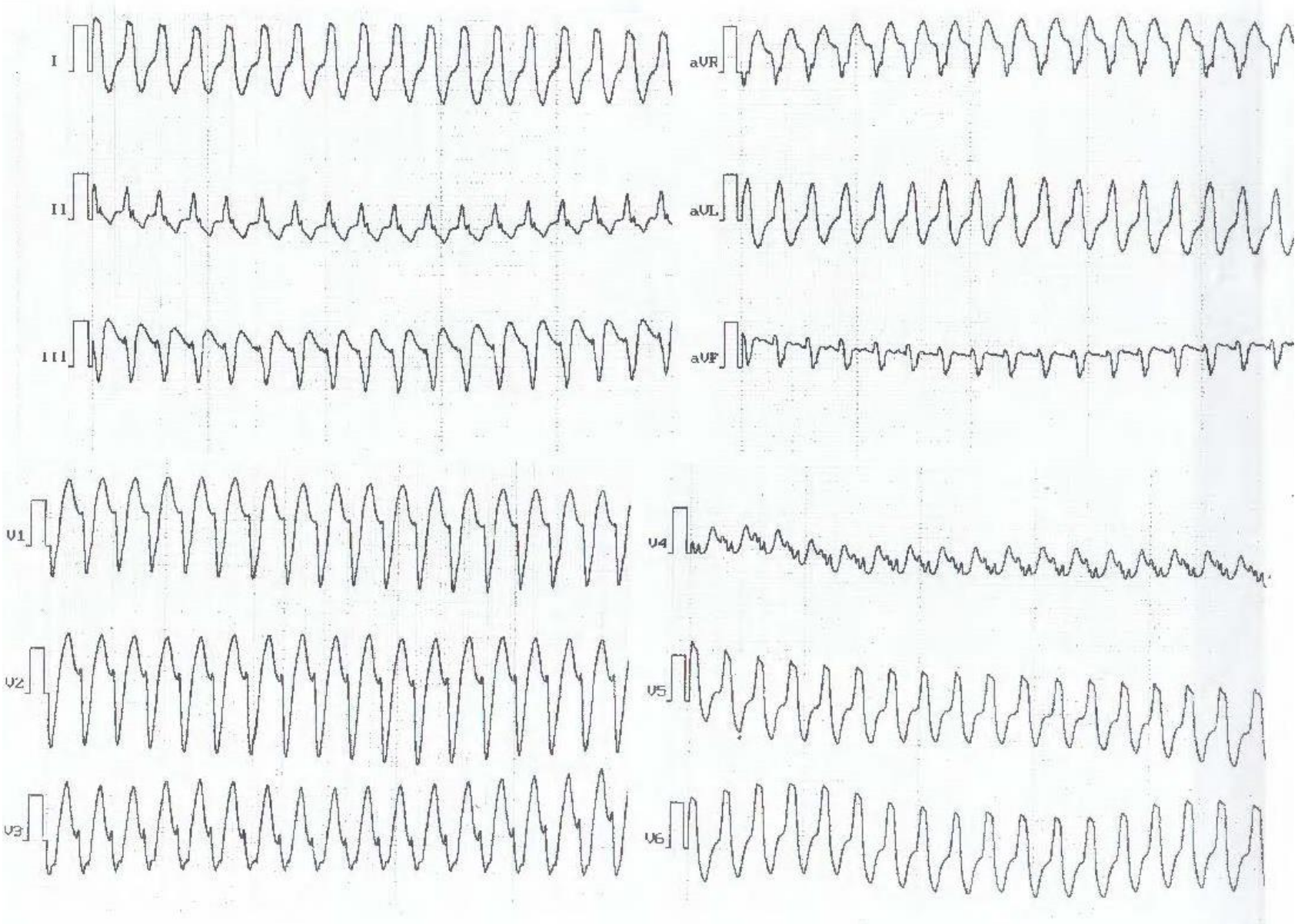
= *stress-induced cardiomyopathy* or *broken heart syndrome*



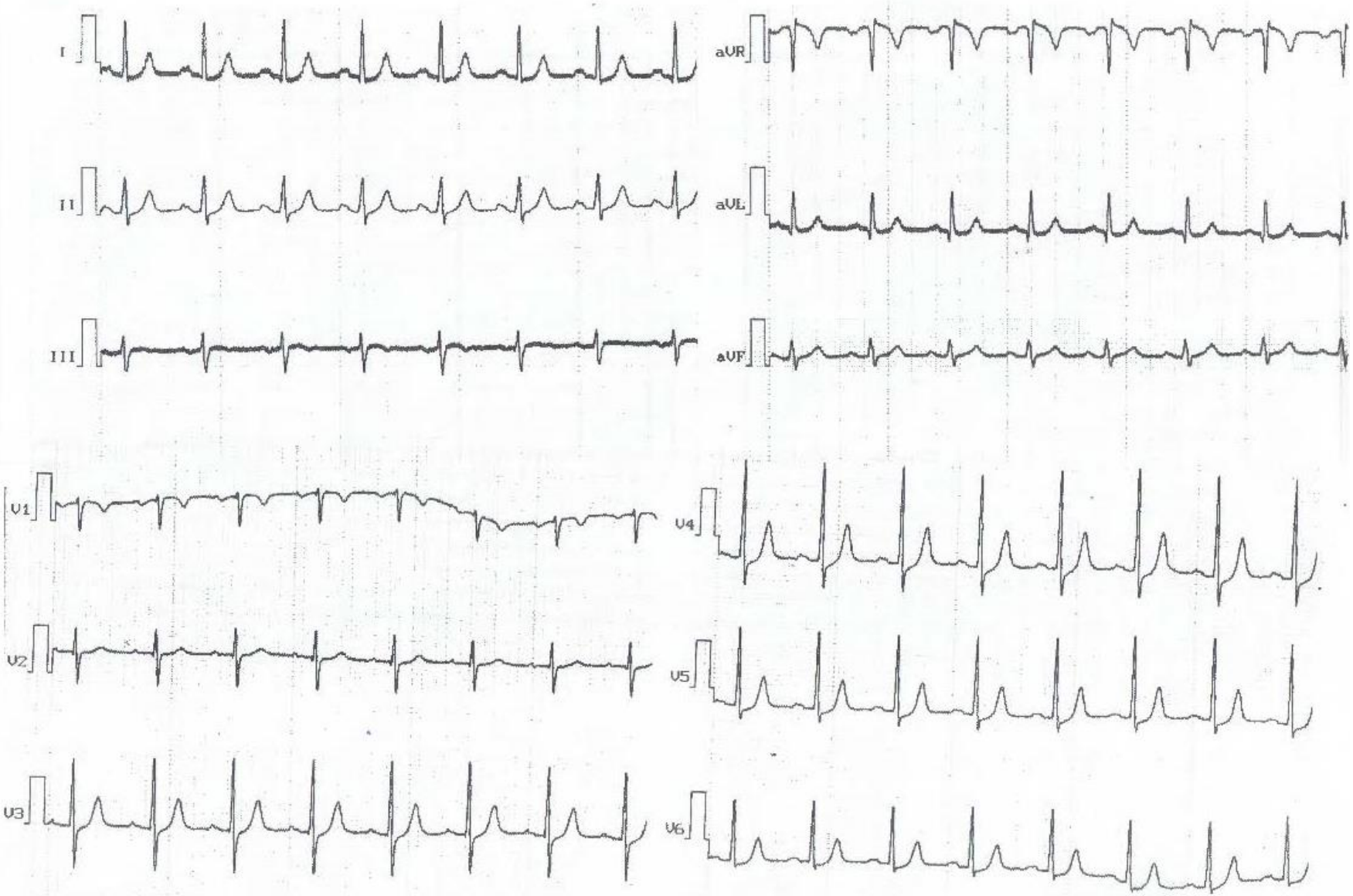
- Found in 1.7–2.2% of patients presenting with ACS
- More commonly seen in postmenopausal women
- Often with recent severe emotional or physical stress
- ECG changes mimic anterior MI
- Cause of acute heart failure, ventricular arrhythmias and rupture
- The treatment is generally supportive (no inotropes!)
- Disappearing of all signs in 1-2 months usually

Stage 3. Master

A. Ventricular tachycardia
B. Atrial flutter
C. Supraventricular tachycardia
D. Antidromic tachycardia in WPW

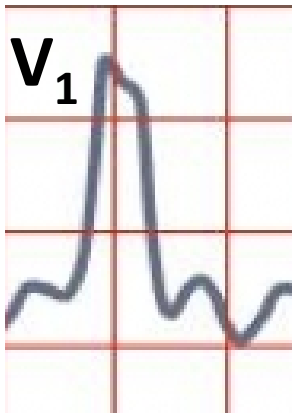


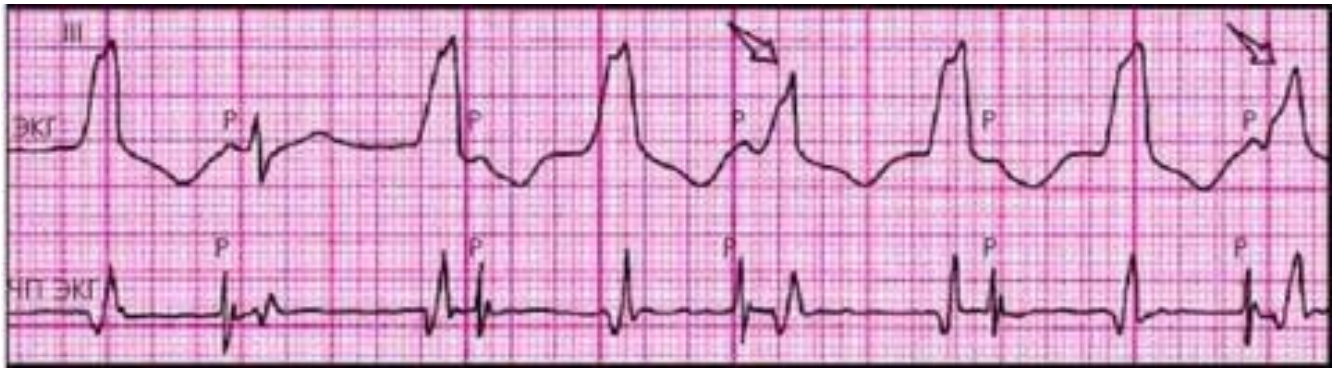
ECG of the same patient in a few minutes after ATP 20 mg iv bolus



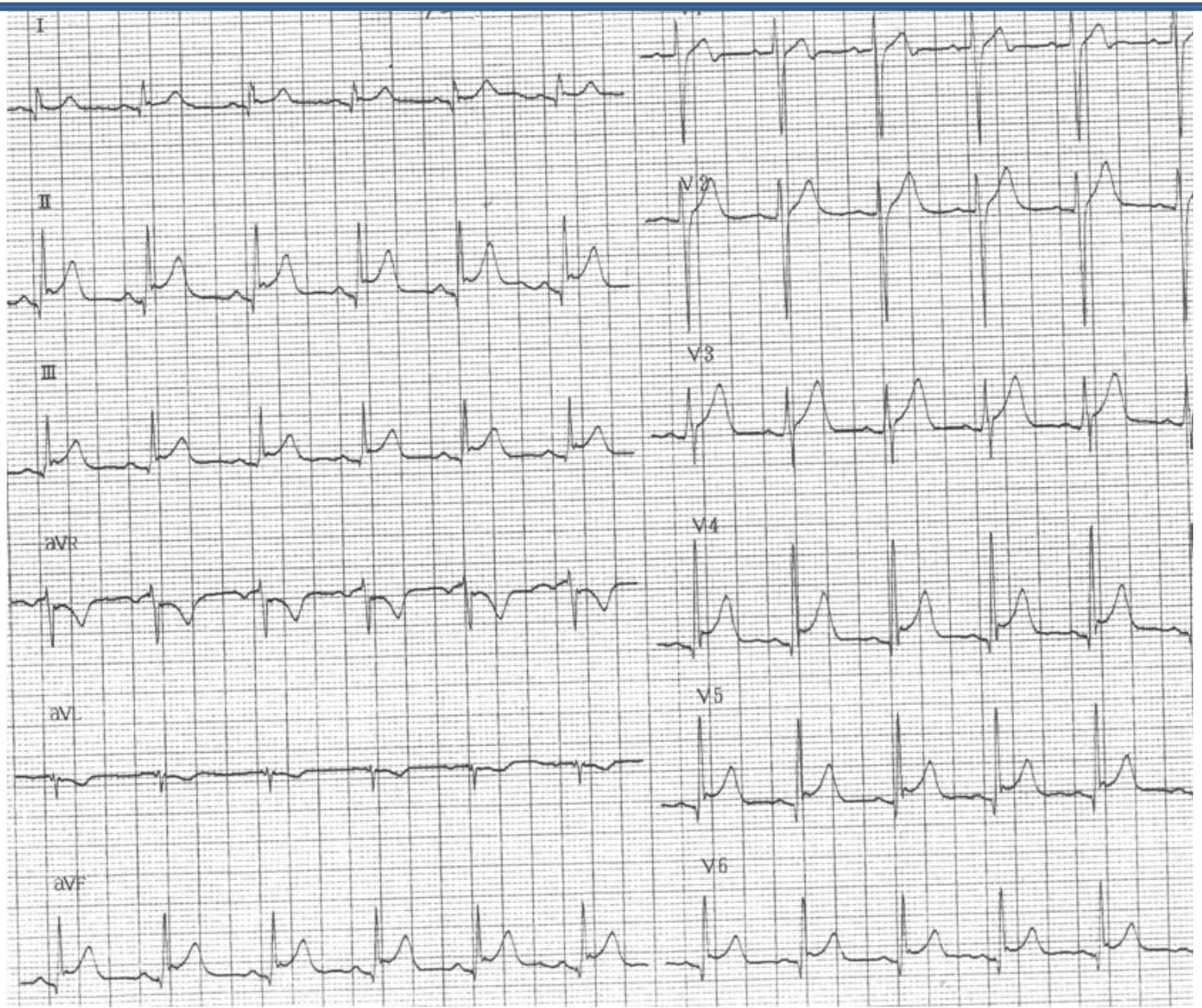
Main differences of ventricular vs supraventricular aberrant tachycardia

- ✓ Negative QRS complexes in V4-V6
- ✓ QR in any of V4-V6
- ✓ AV dissociation
- ✓ Fusion and capture beats
- ✓ Taller left rabbit ear
- ✓ ***Consider as VT if not proved the other!***





A. **Early repolarization syndrome**
B. Brugada syndrome
C. Inferior-lateral STEMI
D. Acute pericarditis

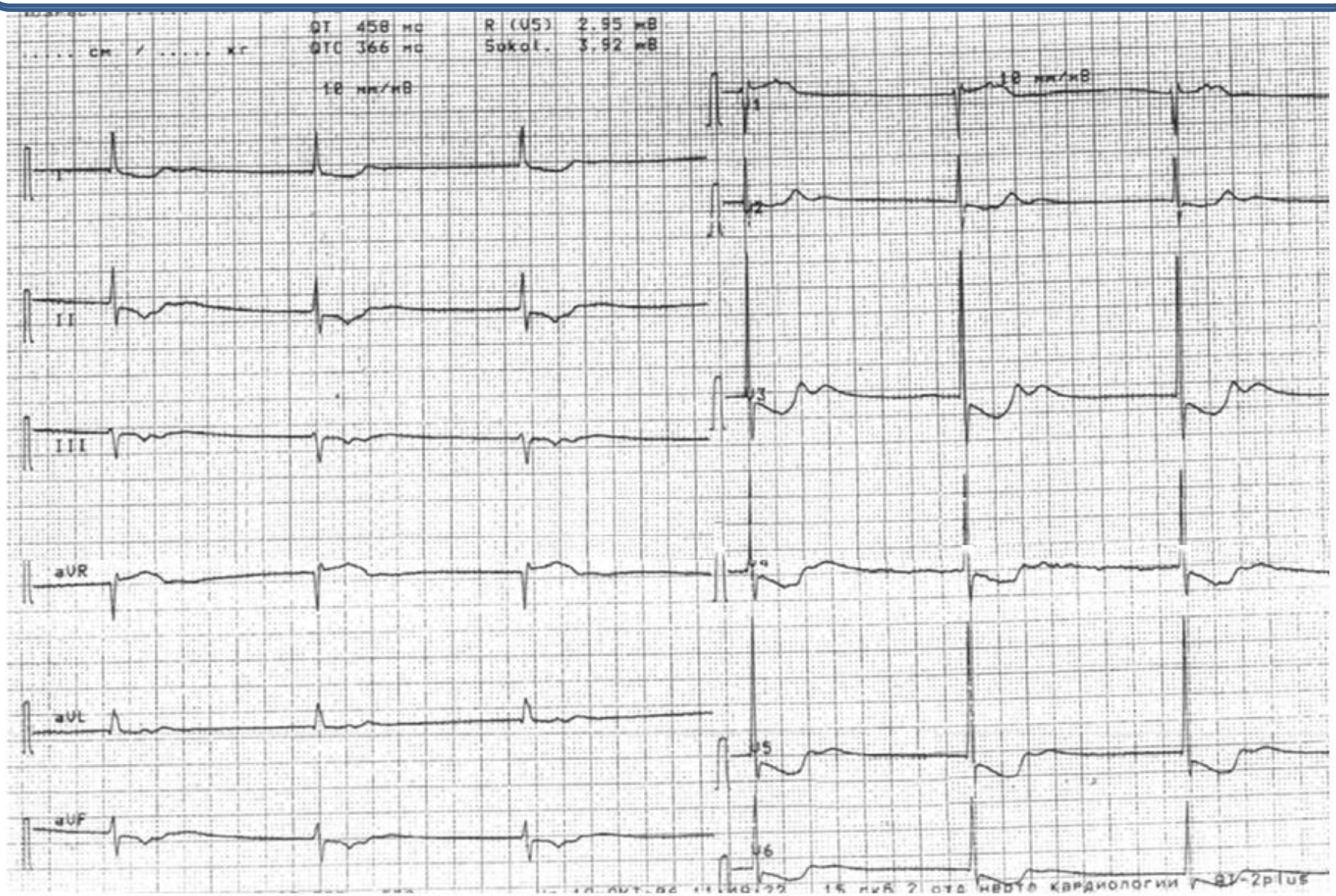


Early repolarization syndrome

ERS identifying in 1-9% of the general population, more often in men, leading sedentary lifestyle, athletes and blacks, in patients with connective tissue dysplasia.

- Notch on the downsloping portion of QRS complex (J wave)
- ST-segment elevation with upward concavity
- Asymmetric high amplitude T waves
- U waves appearance
- Regression of changes at physical activity.

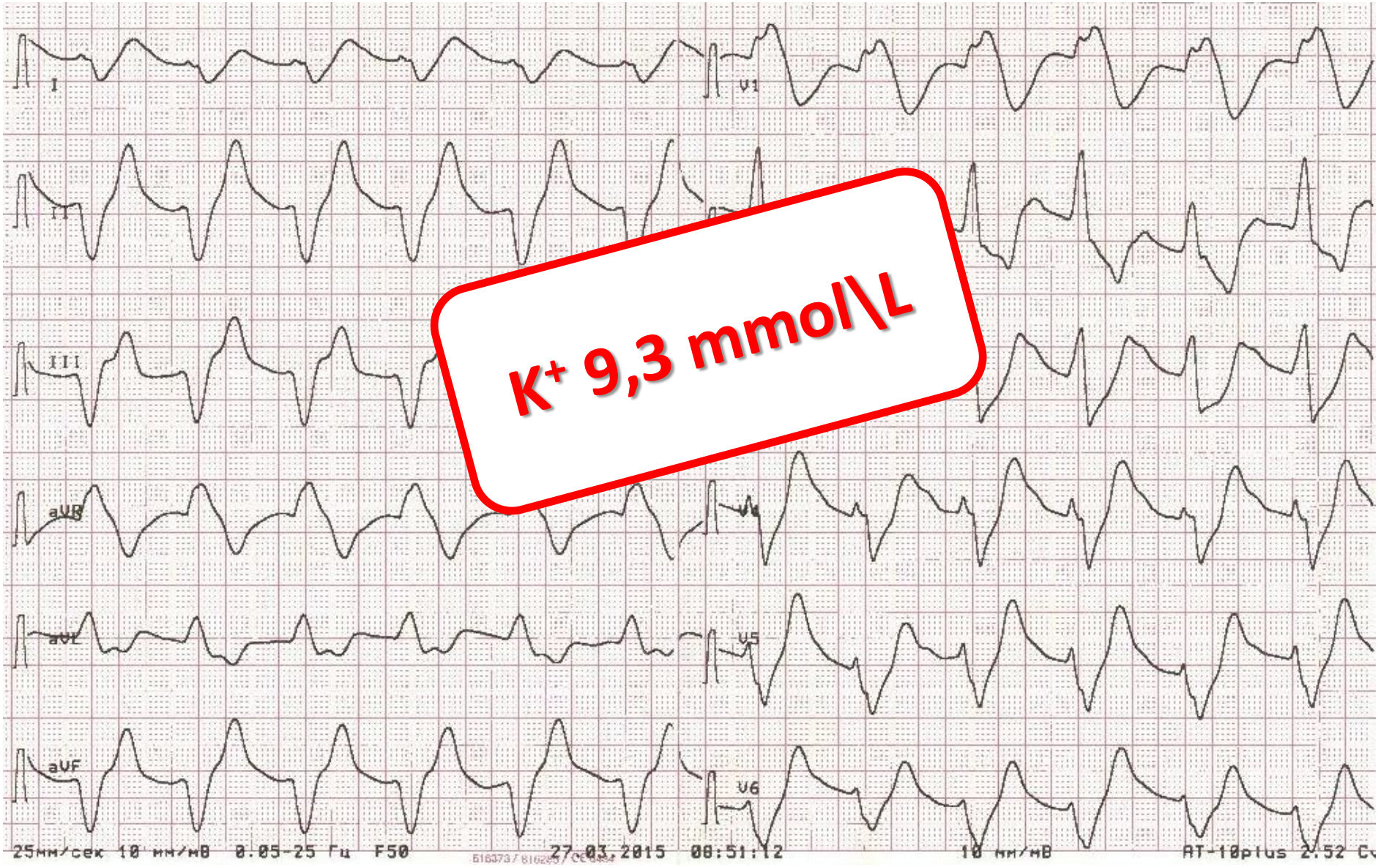
A. Sinus bradycardia
B. **Hypopotassemia**
C. Anterior and lateral wall ischemia
D. AV block



Hypopotassemia

- ***Etiology:*** vomiting, diarrhea, usage of digoxin, diuretics, laxative medications, B_{12} vitamin or folic acid, high dosage of insulin, primary hyperaldosteronism, hyperglycemia, family periodic paralysis
- ***ECG findings:*** trough-shaped ST-segment depression, T wave flattening or inversion, QT interval prolongation, U wave appearance

A. Inferior STEMI
B. RBBB
C. Ventricular tachycardia
D. Hyperpotassemia

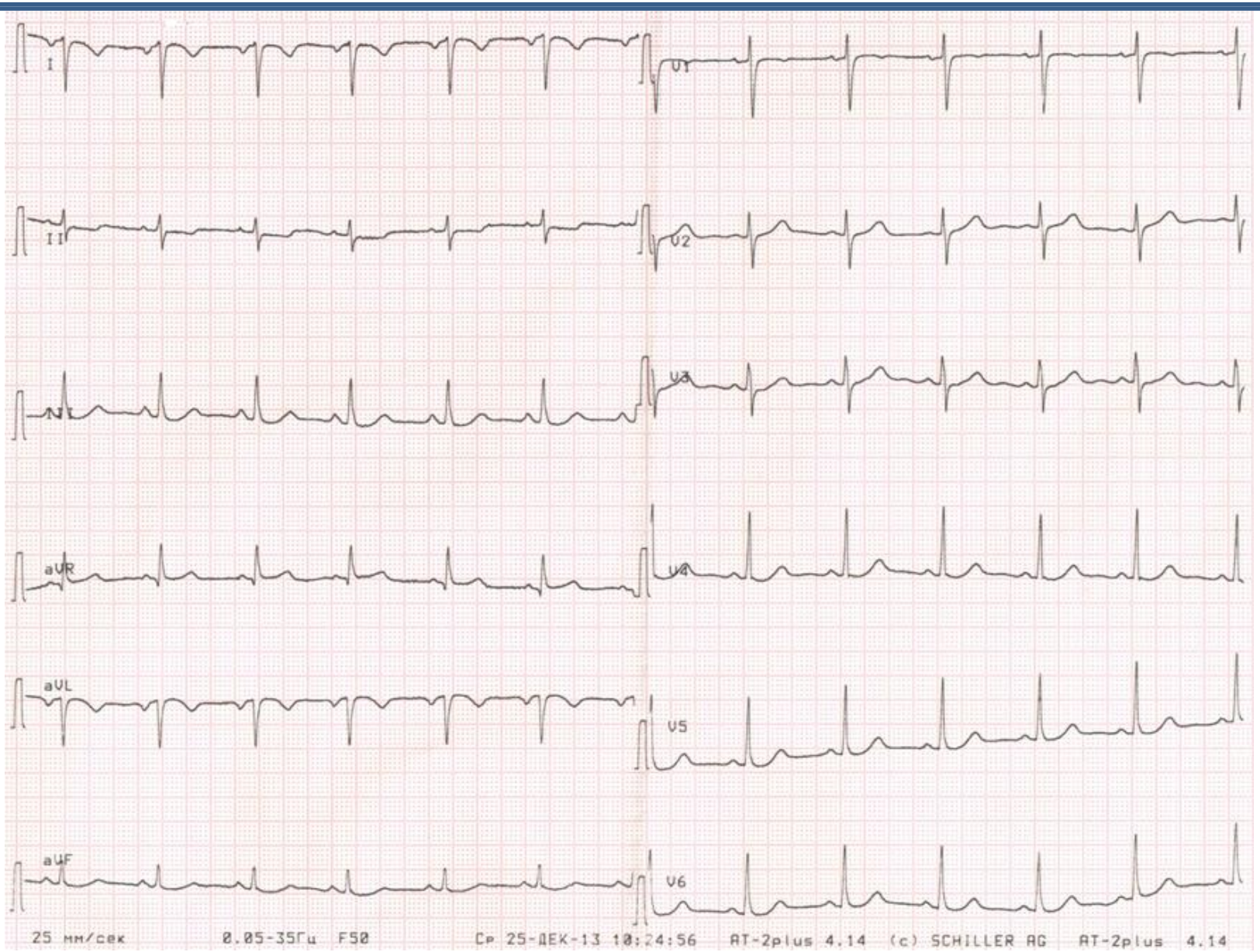


Hyperpotassemia

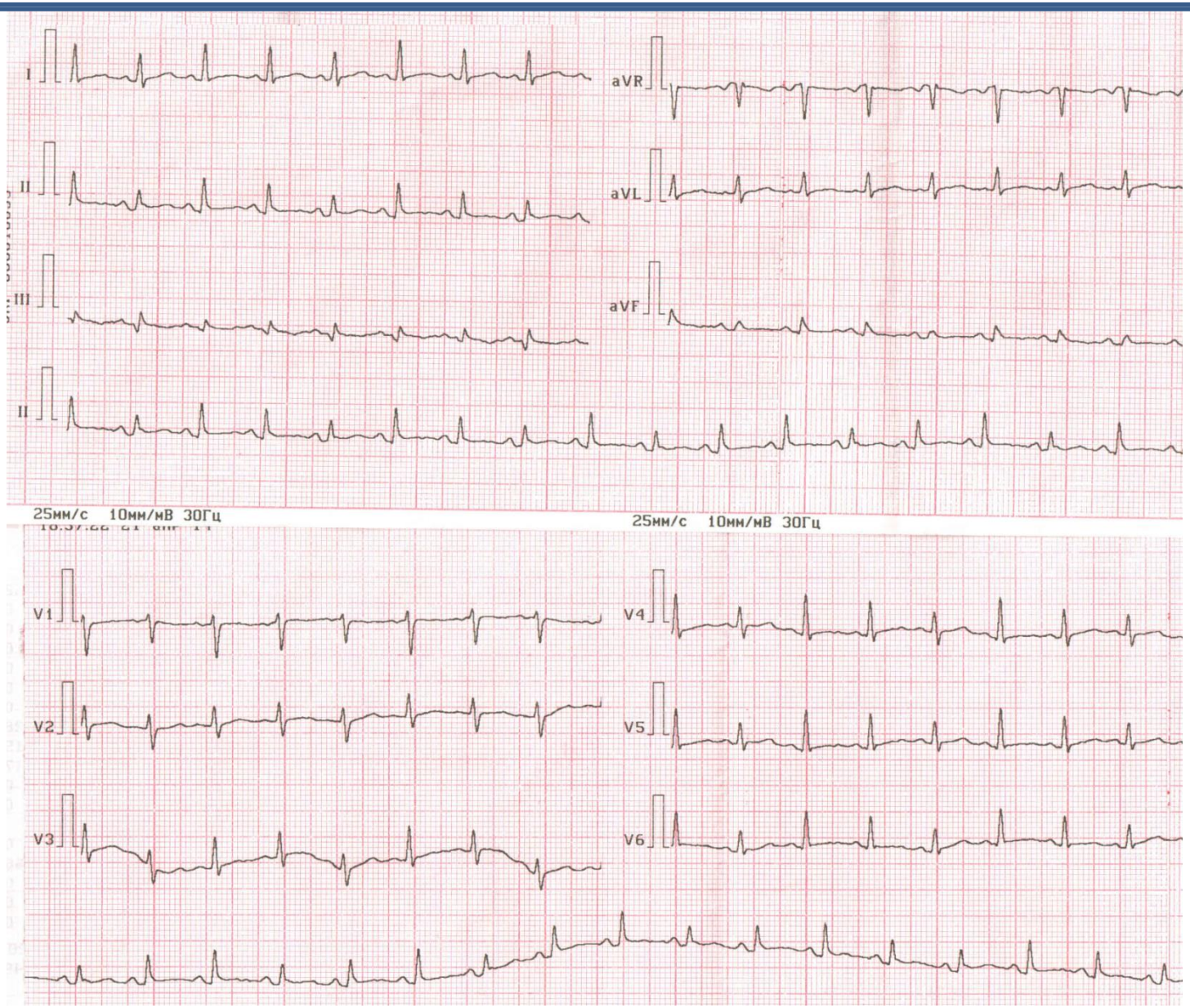
- ***Etiology:*** ineffective elimination (renal failure, medications (ACE inhibitors, potassium-sparring diuretics, NSAIDs), mineralocorticoid deficiency), excessive release from cells (burns, hemolysis, blood transfusion, digoxin or beta-blockers overdose), excessive intake
- ***ECG findings:*** reduction of P-waves' size, peaked T waves, PQ interval prolongation, widening of QRS-complexes, arrhythmias
- ***Patiromer*** is a new medication for treatment of hyperpotassemia.

Stage 4. The lord of ECG

A. Lateral MI
B. Incorrect electrodes' placement
C. Dextrocardia
D. Kind of normal ECG



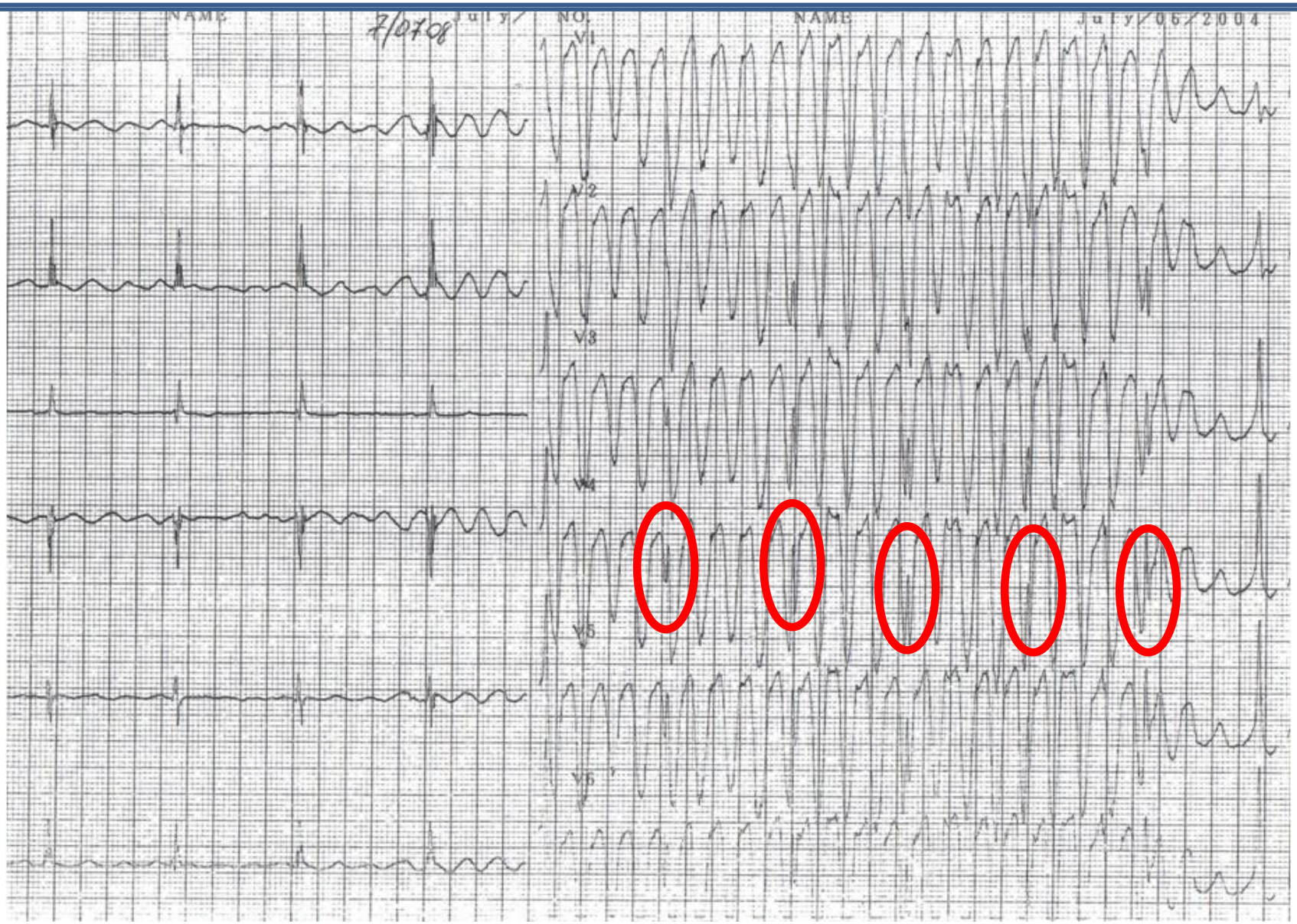
A. Pulmonary embolism
B. **Pericardial effusion**
C. Non-STEMI
D. Transient WPW syndrome



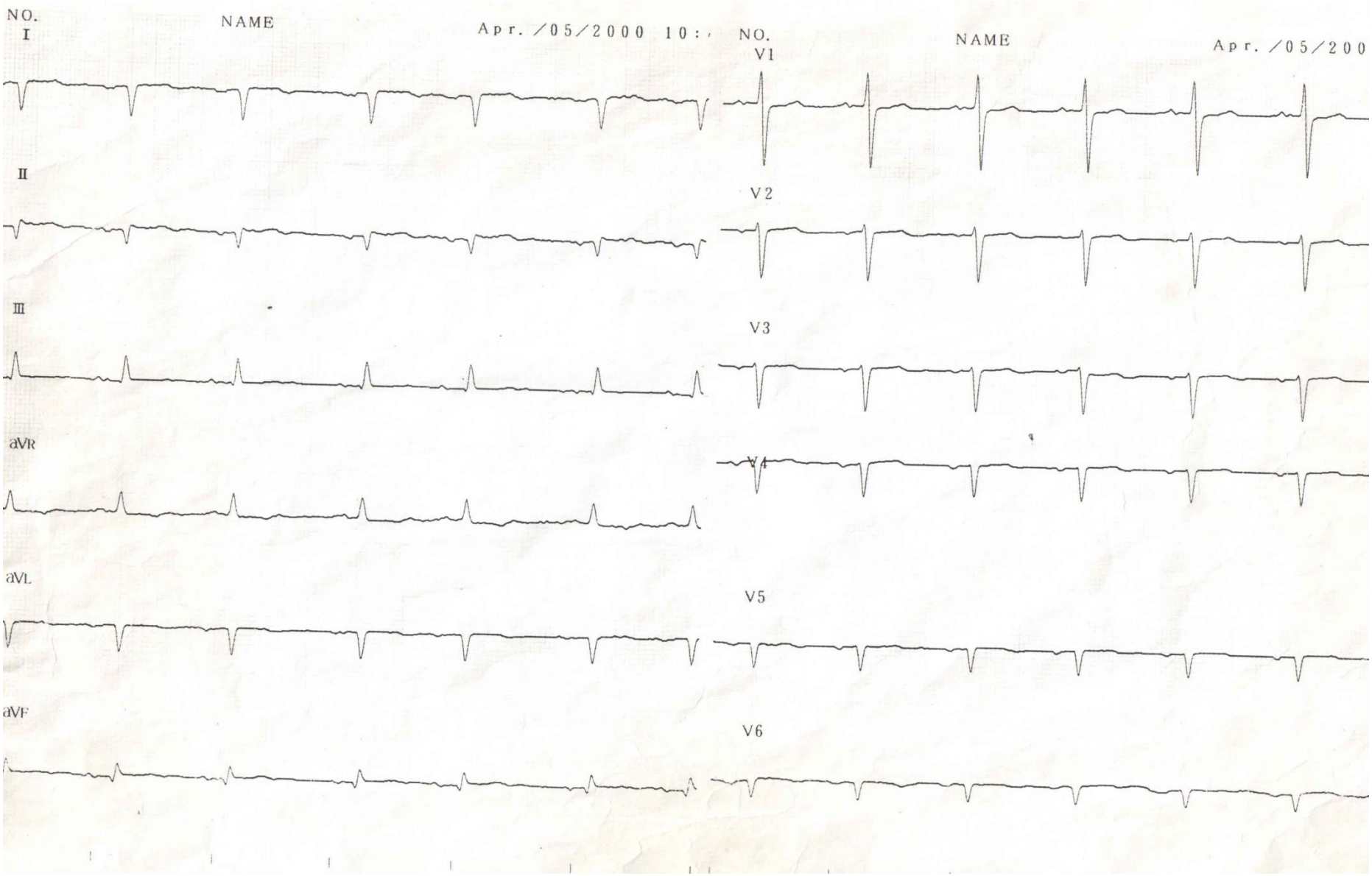
ECG findings in pericarditis

- Sinus tachycardia
- Concordant ST segment elevation in multiple leads, usually without reciprocal changes
- PQ interval depression
- Alternation of QRS complexes
- Low amplitude of QRS complexes in case of effusion
- Absence of pathological Q wave

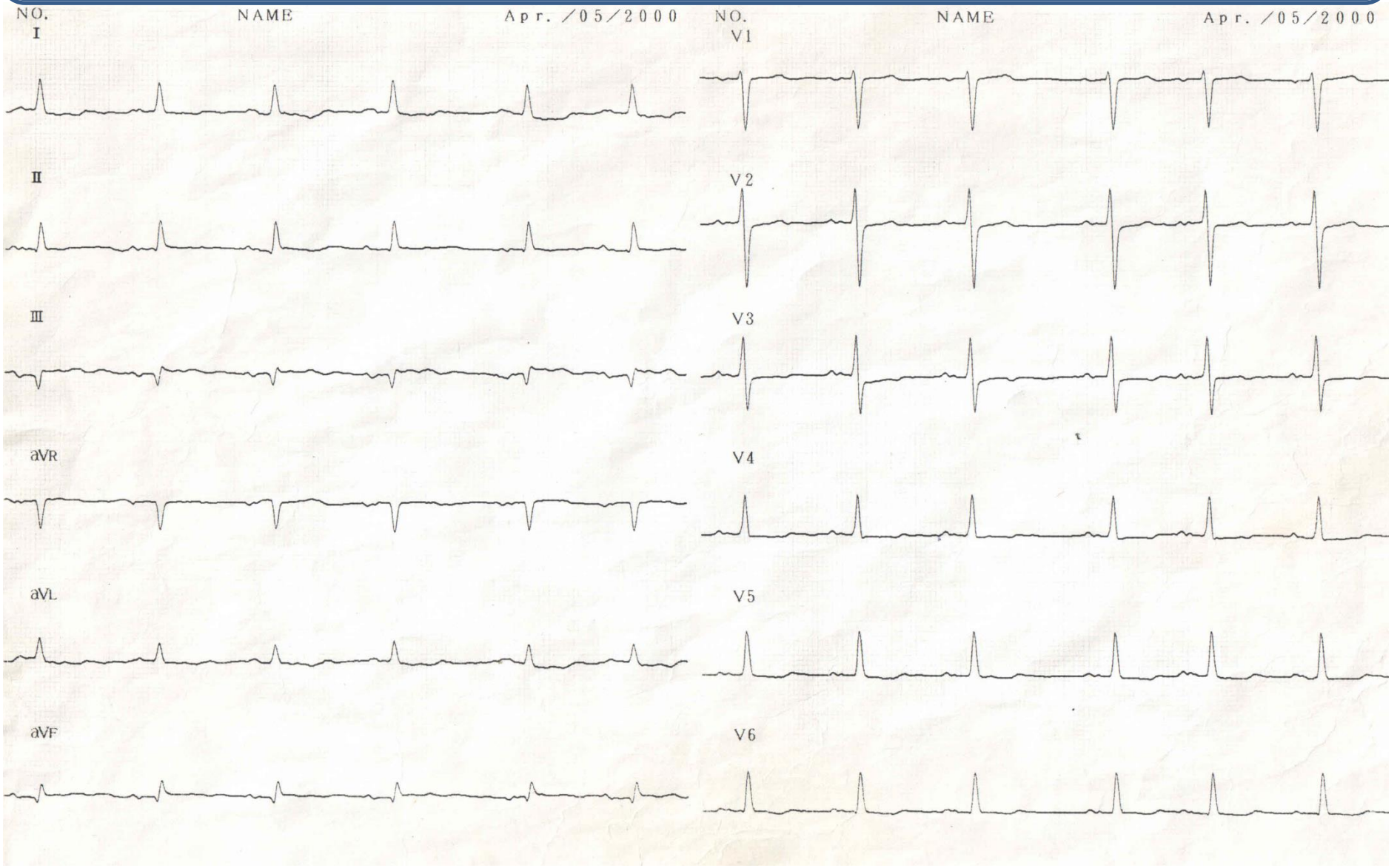
A. Atrial flutter
B. Ventricular tachycardia
C. Atrial fibrillation
D. Normal sinus rhythm



45 years old man admitted to the hospital with paroxysm of atrial fibrillation; sinus rhythm was restored in ambulance



A. Inferior MI
B. Incorrect electrodes' placement
C. Kind of normal ECG
D. Something else

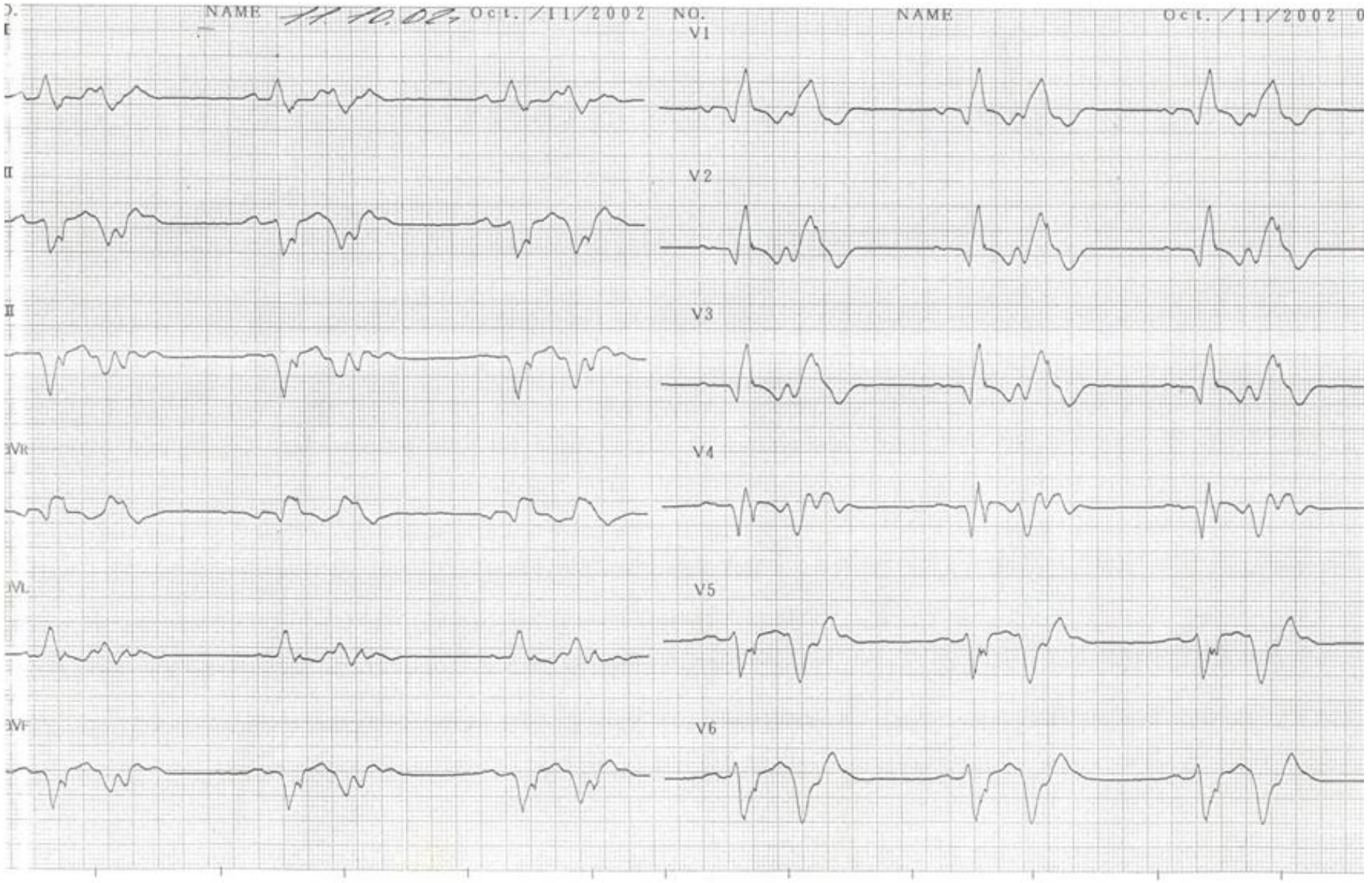


Dextrocardia

- Low voltage of QRS complexes
- Absence of enlargement of R wave in chest leads, with rS type configuration
- Non-specific changes in apical leads

A. Dextrocardia with situs inversus viscerum
B. Isolated dextrocardia (without situs inversus viscerum)
C. Dextroposition of the heart

A. Ventricular bigeminy
B. Old anterior MI
C. RBBB
D. P-mitrale



6 steps of proper ECG interpretation

- ✓ Validation of ECG recording (electrodes, voltage, speed)
- ✓ Analysis of rhythm and conduction (source, regularity, rate)
- ✓ Evaluation of electrical axis position
- ✓ Estimation of intervals and waves (PQ, QRS, ST, T, QT)
- ✓ Additional waves (Δ, J, U) and complexes (premature beats)
- ✓ Conclusion

Can you show ECG with your hands?


Best wishes and good luck
from Moscow!