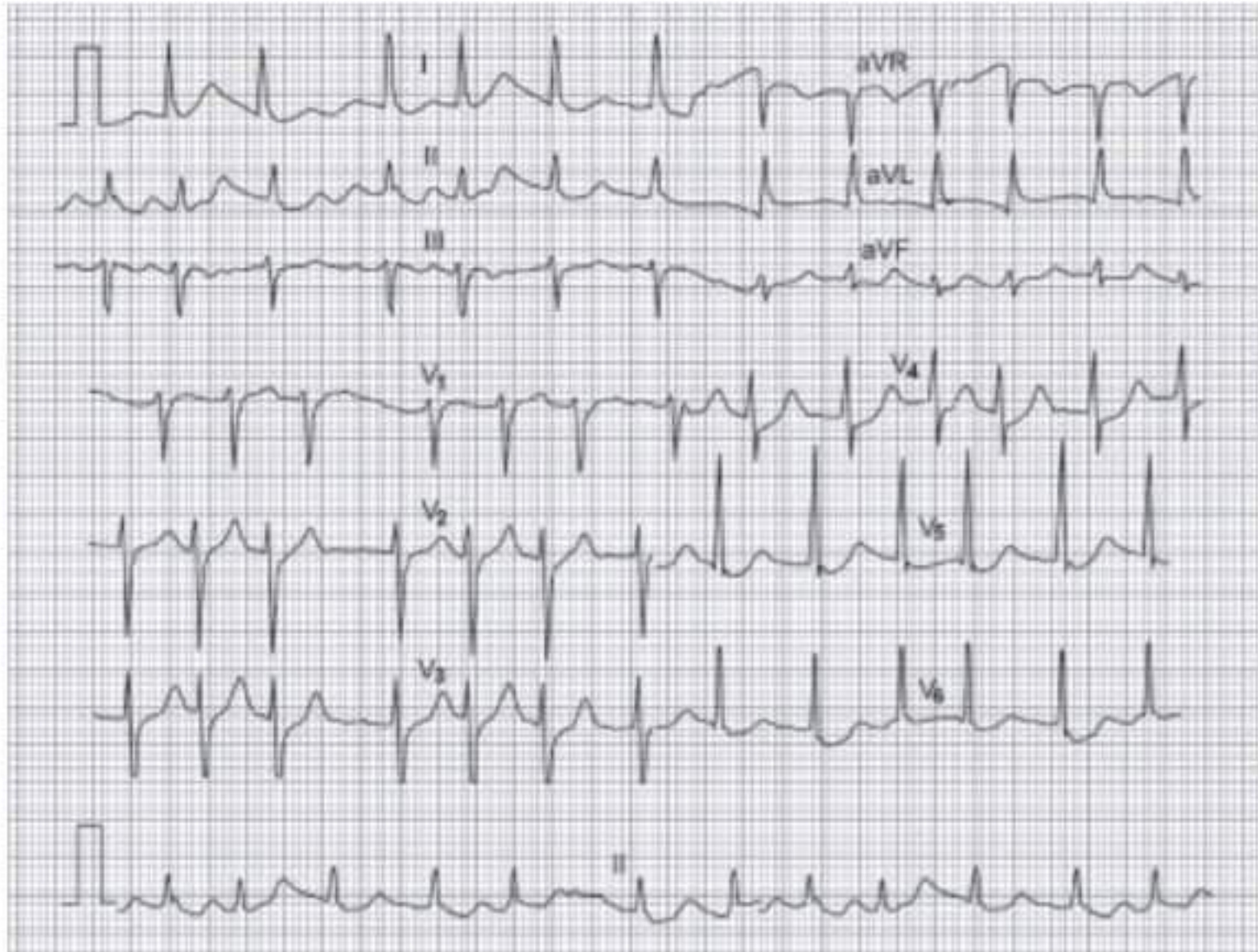


ECG 01: ATRIAL FIBRILLATION



Atrial fibrillation

Q: Write down three important **abnormal findings** in this ECG.

A: As follows:

- P-wave is absent.
- Rhythm is irregularly irregular (R–R interval is irregular).
- There are fibrillary waves.

Q: What is the **heart rate**?

A: 125 beats/min.

Q: What is your **diagnosis**?

A: Atrial fibrillation.

Q: Write down five important **causes**.

A: As follows:

- Chronic rheumatic heart disease, usually with mitral stenosis.
- Acute myocardial infarction.
- Thyrotoxicosis.
- Hypertension.
- Lone atrial fibrillation.

Q: Write down two important **complications**.

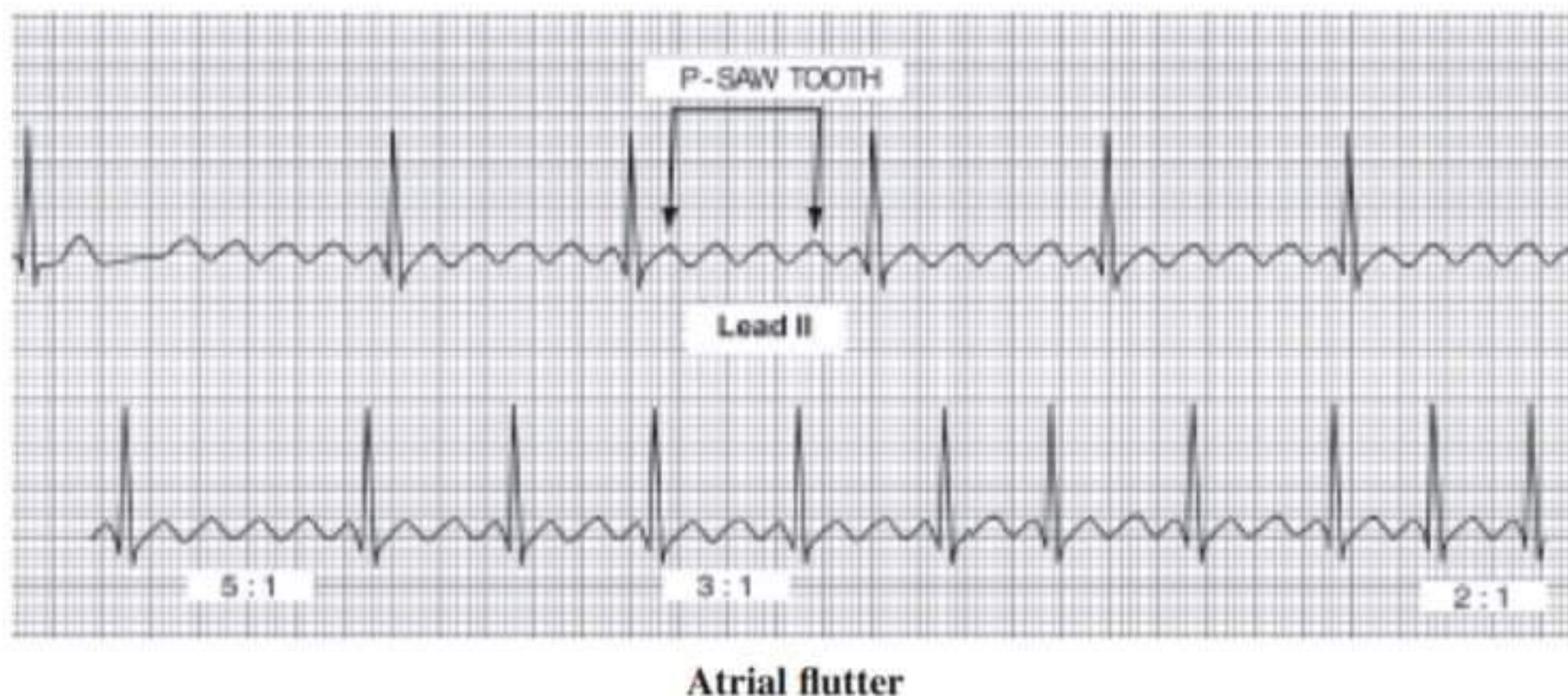
A: As follows:

- Thromboembolism (systemic and pulmonary).
- Heart failure.

Q: If the patient is asymptomatic, mention simple **management**.

A: Low-dose aspirin should be given to prevent thromboembolism.

ECG 02: ATRIAL FLUTTER



Atrial flutter

Q: Write down three important **abnormal findings** in this ECG.

A: As follows:

- P-wave: Saw-toothed appearance (normal P-wave is replaced by flutter or F-wave).
- R-R interval: Irregular.
- Atrial rate: 300 beats/min, ventricular rate is variable (2:1, 3:1 etc.).

Q: What is your **diagnosis**?

A: Atrial flutter with a variable block.

Q: How to **treat**?

A: As follows:

- To control heart rate: Digoxin, β -blocker or verapamil etc. may be used.
- If no response and the patient has troublesome symptoms: Direct current (DC) cardioversion or atrial overdrive pacing may be done.
- If still no response: Radiofrequency catheter ablation.

ECG 03: VENTRICULAR TACHYCARDIA



Ventricular tachycardia

Q: Write down three important **abnormal findings** in this ECG.

A: As follows:

- P-wave: Absent.
- QRS complex: Broad >0.14 seconds (abnormal or bizarre pattern).
- Ventricular rate: 130 beats/min.

Q: What is your **diagnosis**?

A: Ventricular tachycardia.

Q: Mention two **differential** diagnoses.

A: As follows:

- SVT with RBBB.
- SVT with WPW syndrome.

Q: Mention five **causes**.

A: As follows:

- Acute myocardial infarction.
- Myocarditis.
- Cardiomyopathy.
- Ventricular aneurysm.
- Electrolyte imbalance (mainly hypokalaemia and hypomagnesaemia).

ECG 04: ACUTE MYOCARDIAL INFARCTION

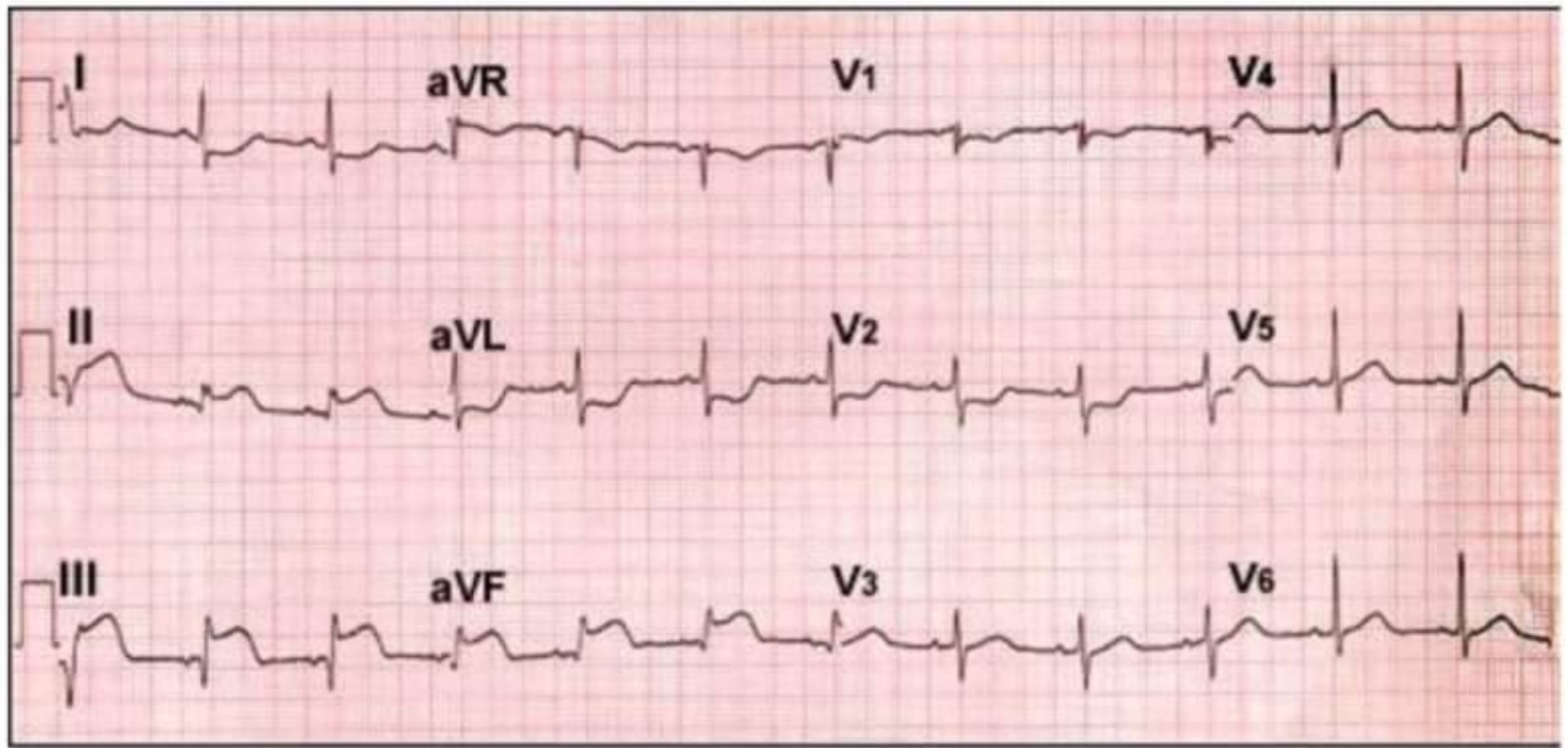


Fig. A: Acute inferior myocardial infarction

Q: Write down two important **abnormal findings** in the ECG shown in Figure A.

A: As follows:

- ST elevation in II, III and AVf.
- ST depression with inverted T-wave in I, AVl and V2.

Q: What is your **diagnosis**?

A: Acute inferior myocardial infarction.

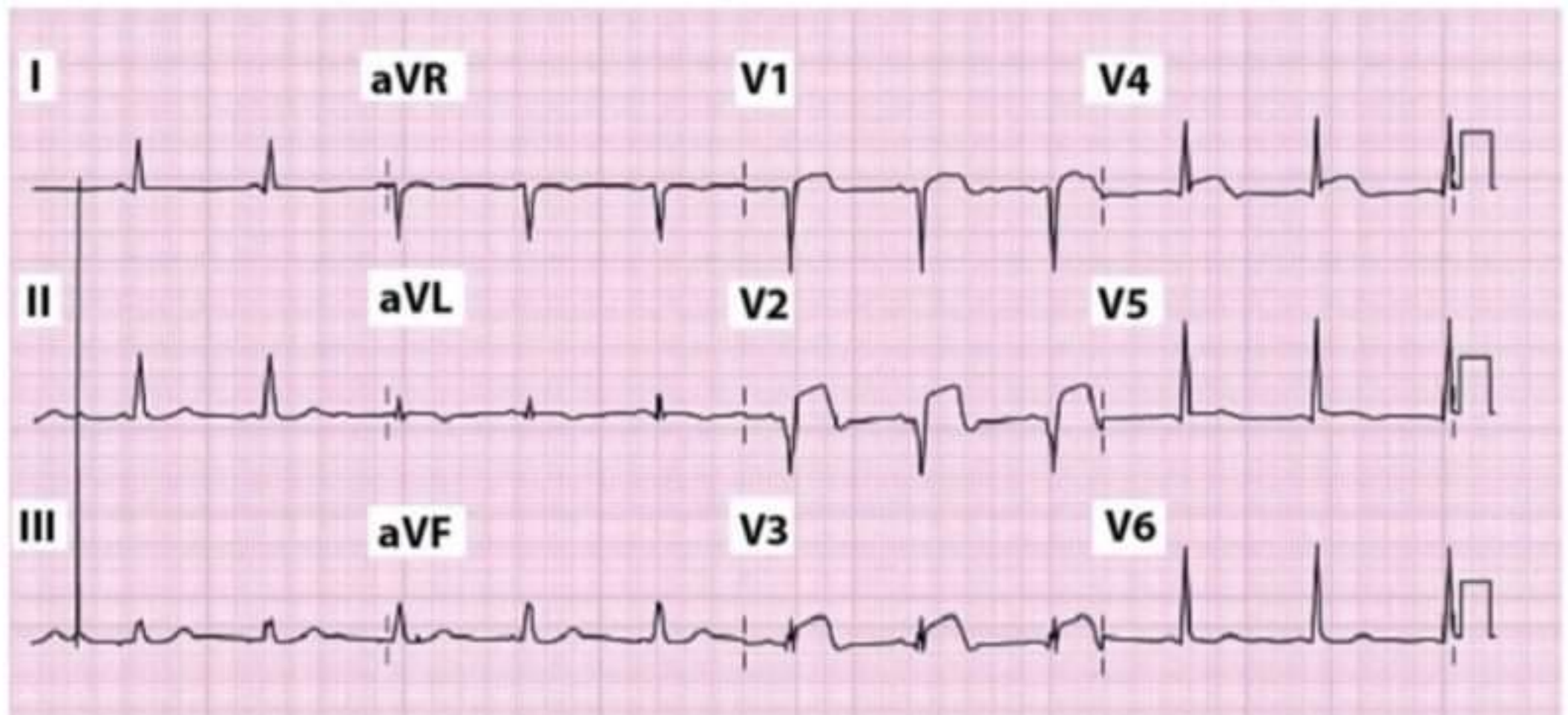


Fig. B: Acute anteroseptal myocardial infarction

ECG 05: OLD MYOCARDIAL INFARCTION

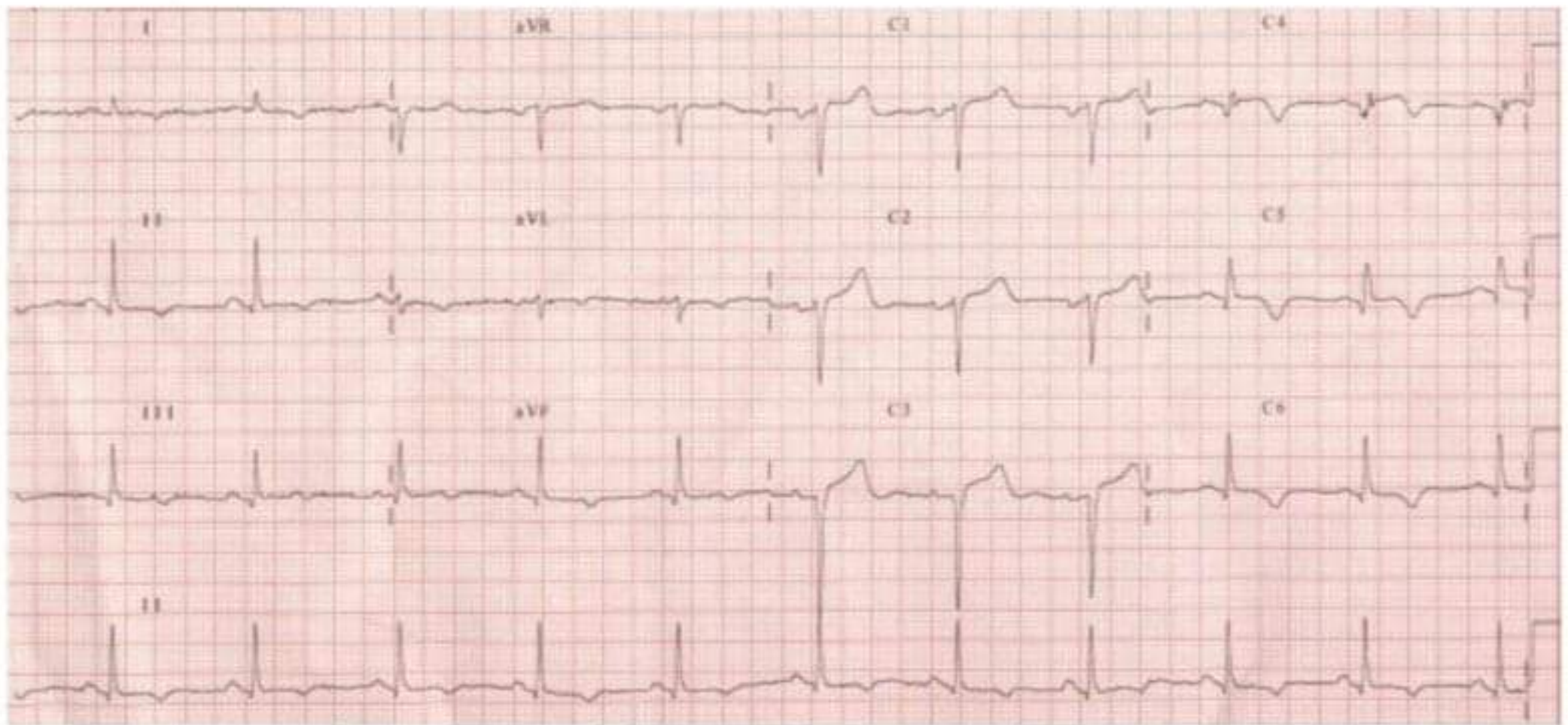


Fig. A: Old anterior myocardial infarction

Q: Write down two important **abnormal findings** in the ECG shown in Figure A.

A: As follows:

- Pathological Q-waves in C1, C2 and C3.
- T inversion in C4, C5 and C6.

Q: What is your **diagnosis**?

A: Old anterior myocardial infarction.

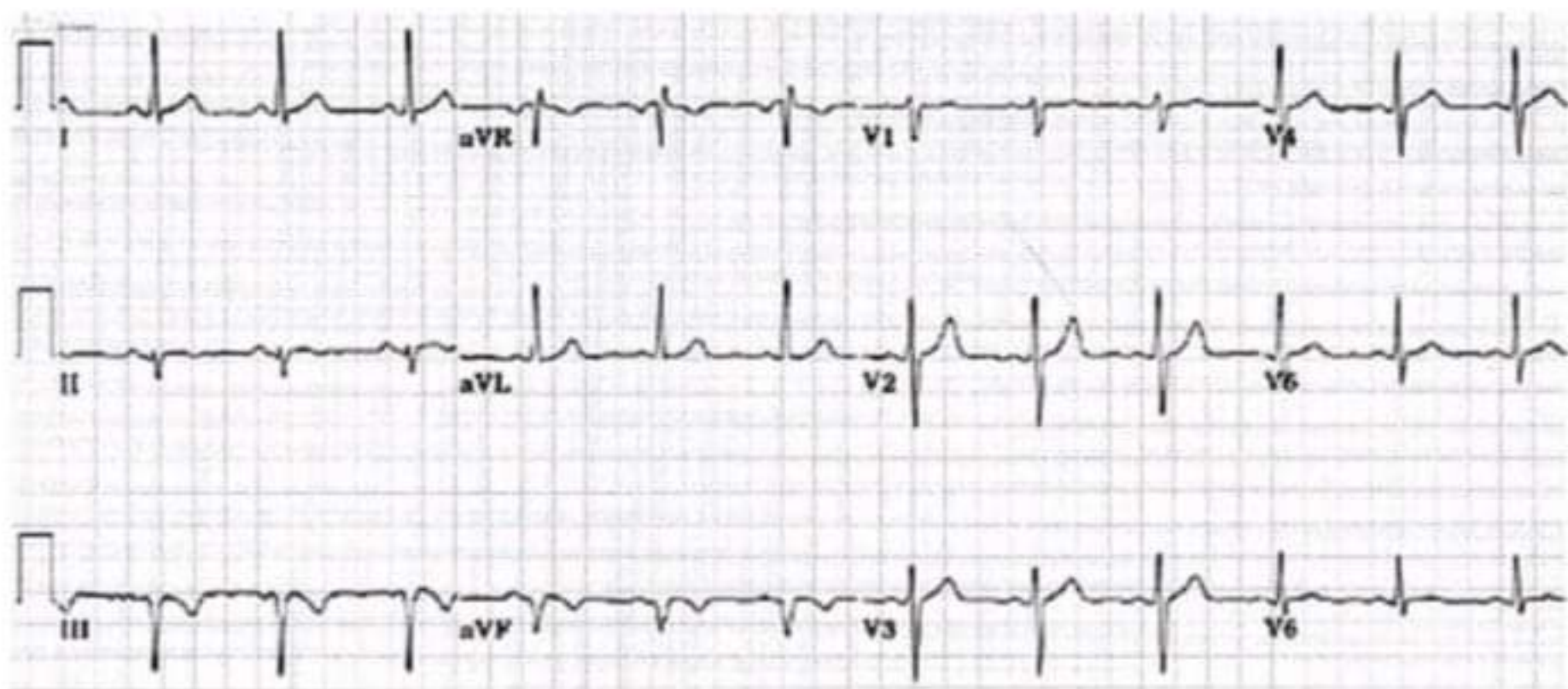


Fig. B: Old inferior myocardial infarction

Q: What is the **abnormal finding** in the ECG shown in Figure B?

A: Pathological Q-wave in II, III and AVf.

Q: What is your **diagnosis**?

A: Old inferior myocardial infarction.

ECG 06: FIRST-DEGREE AV BLOCK



First-degree AV block

Q: What is the abnormal **finding** in this ECG?

A: P–R interval is prolonged >0.22 seconds (normal 0.12–0.20 seconds).

Q: What is your diagnosis?

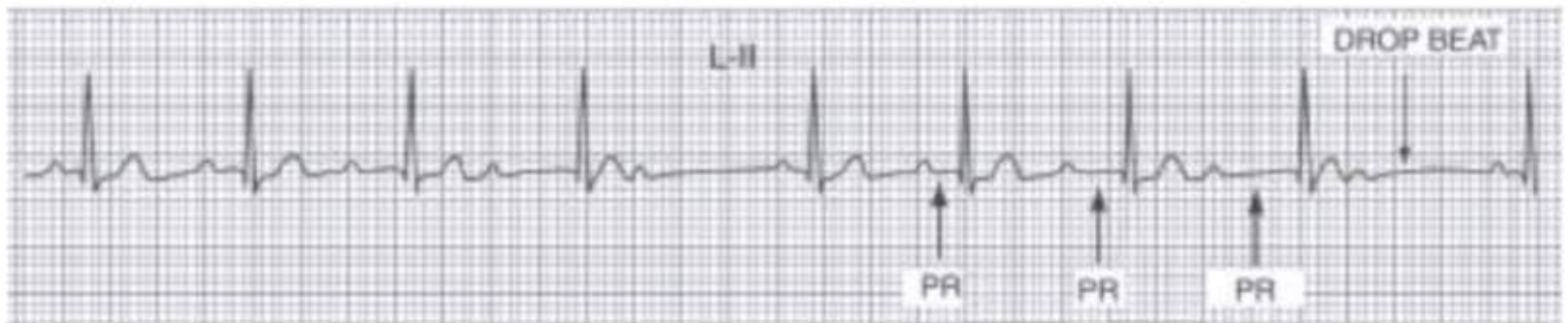
A: First-degree AV block.

Q: Mention four **causes**?

A: As follows:

- Digoxin toxicity.
- Acute myocardial infarction (common in inferior myocardial infarction).
- Acute rheumatic carditis.
- Hyperkalaemia.

ECG 07: SECOND-DEGREE AV BLOCK (MOBITZ TYPE I)



Second-degree AV block (Mobitz type I)

Q: Write down two important **abnormal findings** in this ECG.

A: As follows:

- Progressive lengthening of P–R interval, followed by an absent QRS complex (one P is not followed by a QRS complex).
- R–R interval: Irregular (progressive shortening of R–R interval until block occurs).

Q: What is your **diagnosis**?

A: Second-degree AV block, Mobitz type I (Wenckebach phenomenon).

Q: Mention three **causes**?

A: As follows:

- Physiological: Athlete, during rest, sleep (as a result of increased vagal tone).
- Drugs: Digoxin toxicity.
- Acute myocardial infarction (commonly inferior myocardial infarction).

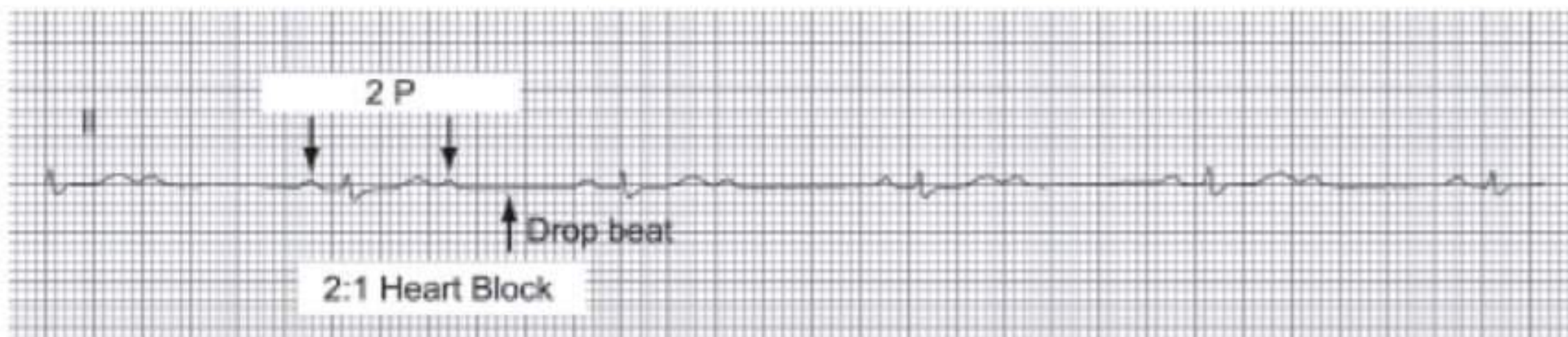
Q: Where is the **lesion**?

A: The block is in the higher area of AV node (proximal to bundle of His).

Q: What is the **prognosis**?

A: Good prognosis.

ECG 08: SECOND-DEGREE AV BLOCK (MOBITZ TYPE II)



Second-degree AV block (Mobitz type II)

Q: Write down three important **findings** in this ECG.

A: As follows:

- P–R interval is constant (also P–P interval constant).
- QRS complex: Wide.
- Alternate P-wave is conducted.

Q: What is your **diagnosis**?

A: Mobitz type II second-degree AV block with 2:1 conduction.

Q: What are the **complications**?

A: As follows:

- Complete heart block.
- Stokes–Adams syndrome.
- Heart failure.

Q: Where is the **lesion**?

A: Disease of the His–Purkinje system.

Q: Mention the most **likely cause**.

A: Common in acute anterior myocardial infarction.

Q: How to **treat**?

A: As follows:

1. When associated with acute inferior myocardial infarction:
 - If asymptomatic—close monitoring and follow-up.
 - If symptomatic—Inj. atropine 0.6 mg i.v. If no response, temporary pacemaker. The majority will resolve in 7–10 days.
2. If associated with acute anterior myocardial infarction—temporary pacing, followed by permanent pacemaker (because complete heart block may develop).

ECG 09: COMPLETE HEART BLOCK



Complete heart block

Q: Write down three important **abnormal findings** in this ECG.

A: As follows:

- Atrial rate is 60/min, P–P interval is constant.
- Ventricular rate is 35/min.
- There is no relationship between P-wave and QRS complex

Q: What is your **diagnosis**?

A: Complete heart block.

Q: Write down three findings you expect in **CVS (Cardiovascular system) examination**.

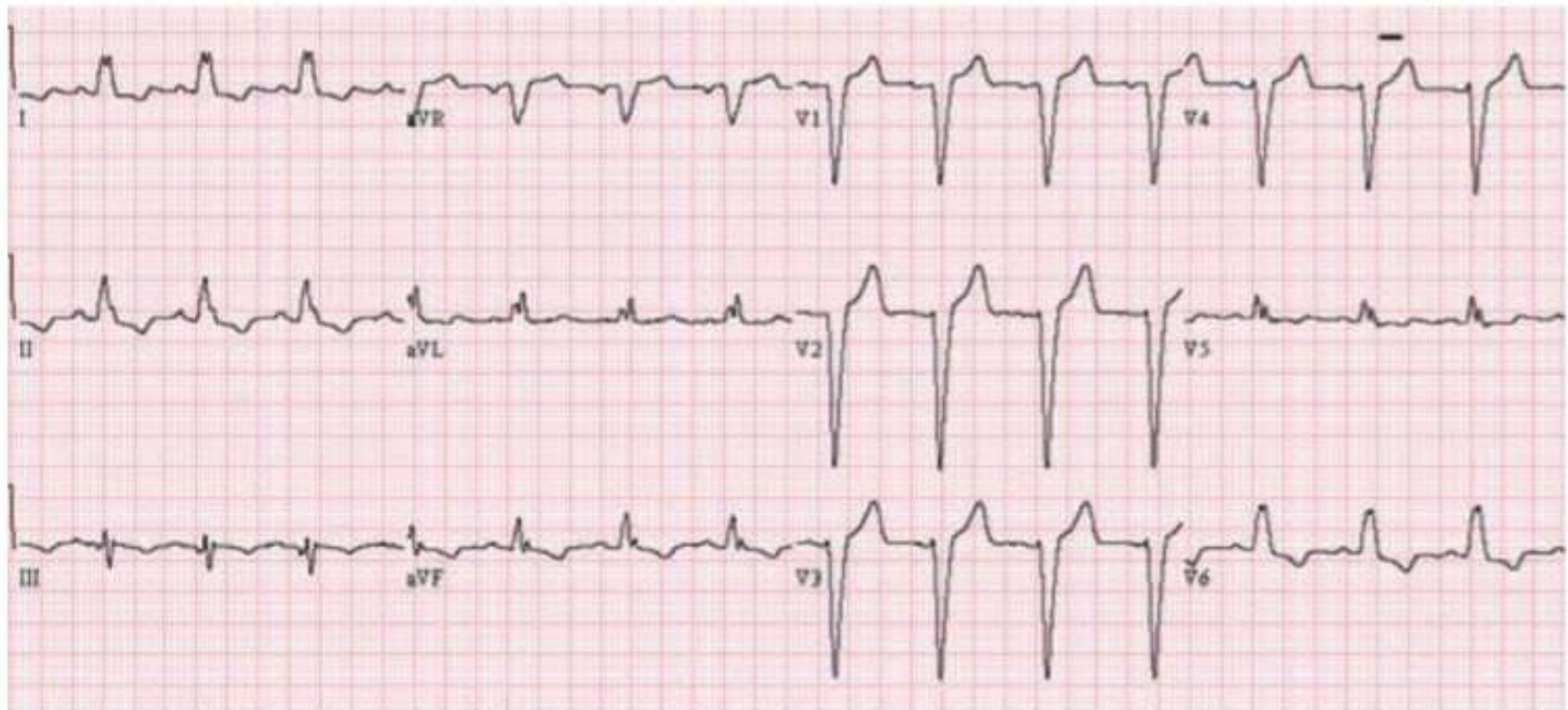
A: As follows:

- Pulse: Bradycardia ($<40/\text{min}$), high volume, does not increase by exercise.
- Cannon waves (large **a**-wave) in the neck vein.
- Variable intensity of the first heart sound.

Q: What is the **management**?

A: Permanent pacemaker.

ECG 10: LEFT BUNDLE BRANCH BLOCK



Left bundle branch block

Q: Write down two important **abnormal findings** in this ECG.

A: As follows:

- Wide QRS complex in all leads.
- RSR' pattern in I, AVl, AVf, V5 and V6.

Q: What is your **diagnosis**?

A: Left bundle branch block.

Q: What finding might you get on **auscultation**?

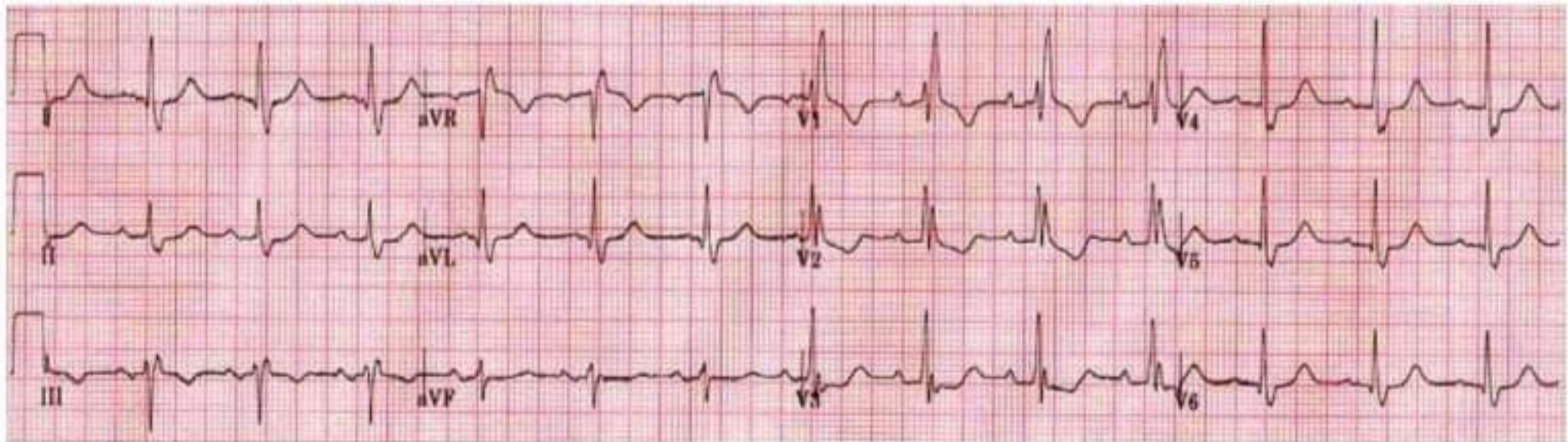
A: Reverse splitting of the second heart sound.

Q: Mention four **causes**.

A: As follows:

- Severe coronary artery disease.
- Acute myocardial infarction.
- Cardiomyopathy.
- Aortic valve disease (stenosis or regurgitation).

ECG 11: RIGHT BUNDLE BRANCH BLOCK



Right bundle branch block

Q: Write down two important **abnormal findings** in this ECG.

A: As follows:

- Wide QRS complex in all leads.
- RSR' pattern in V1, V2 and V3.

Q: What is your **diagnosis**?

A: Right bundle branch block.

Q: Mention three **causes**.

A: As follows:

- Normal variant.
- Coronary artery disease (acute myocardial infarction).
- Atrial septal defect (ASD).
- Cardiomyopathy.

ECG 12: LEFT VENTRICULAR HYPERTROPHY

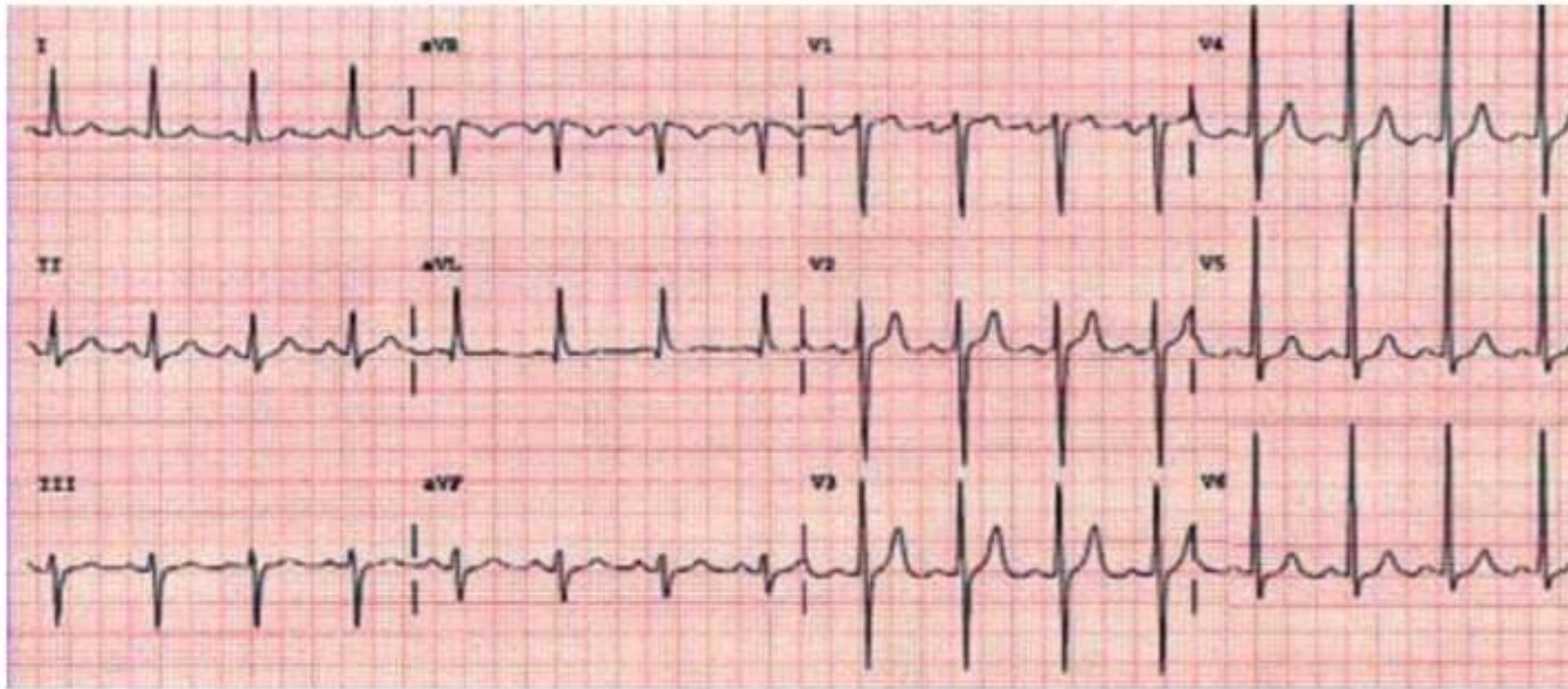


Fig. A: Left ventricular hypertrophy

Q: Write down two **abnormal findings** in the ECG shown in Figure A.

A: As follows:

- S-wave in V1 + R-wave in V6 = 39 mm (criteria: S-wave in V1 + R-wave in V6 >35 mm).
- Left-axis deviation.

Q: What is your **diagnosis**?

A: Left ventricular hypertrophy.

Q: Mention one finding in the examination of **precordium**.

A: Apex beat is heaving in nature.

Q: Mention one **investigation** to confirm the diagnosis.

A: Echocardiography (M-mode).

Q: Mention five **causes**.

A: As follows:

- Systemic hypertension.
- Aortic stenosis.
- Coarctation of aorta.
- Hypertrophic cardiomyopathy.
- Ventricular septal defect.



Fig. B: Left ventricular hypertrophy with strain

Q: Write down two **abnormal findings** in the ECG shown in Figure B.

A: As follows:

- S-wave in V1 + R-wave in V6 = 51 mm (criteria: S-wave in V1 + R-wave in V6 >35 mm).
- ST-wave depression and T-wave inversion in I, aVL, V4–V6.

Q: What is your **diagnosis**?

A: Left ventricular hypertrophy with strain.

Q: What are the **differential diagnoses**?

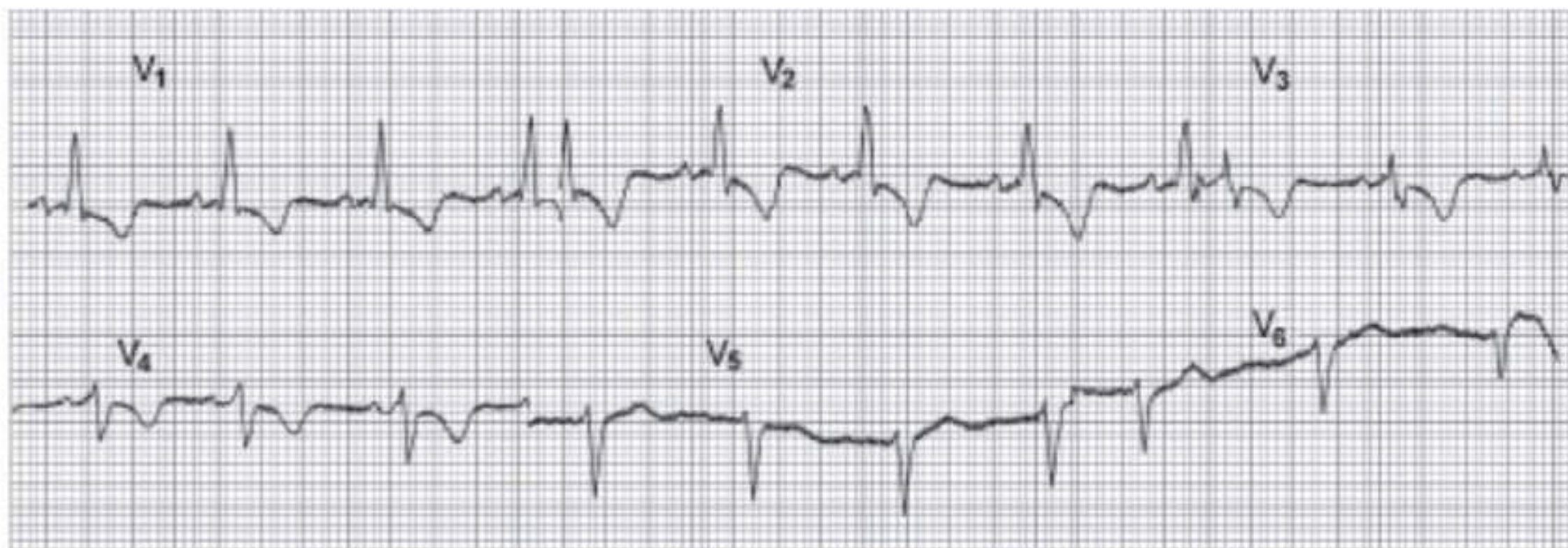
A: As follows:

- Hypertrophic cardiomyopathy.
- Subendocardial myocardial infarction.

Q: Mention one **investigation** to confirm the diagnosis.

A: Echocardiography (two-dimensional [2D] or M-mode).

ECG 13: RIGHT VENTRICULAR HYPERTROPHY



Right ventricular hypertrophy with strain

Q: Write down two **abnormal findings** in this ECG.

A: As follows:

- R-wave in V1 = 10 mm (criteria: tall R-wave in V1 >7 mm).
- ST-wave depression and T-wave inversion (in V1 and V2).

Q: What is your **diagnosis**?

A: Right ventricular hypertrophy with strain.

Q: Mention four **clinical findings**.

A: As follows:

- Palpable P2.
- Left parasternal heave.
- Epigastric pulsation.
- Loud P2 on auscultation.

Q: Mention one **investigation** to confirm the diagnosis.

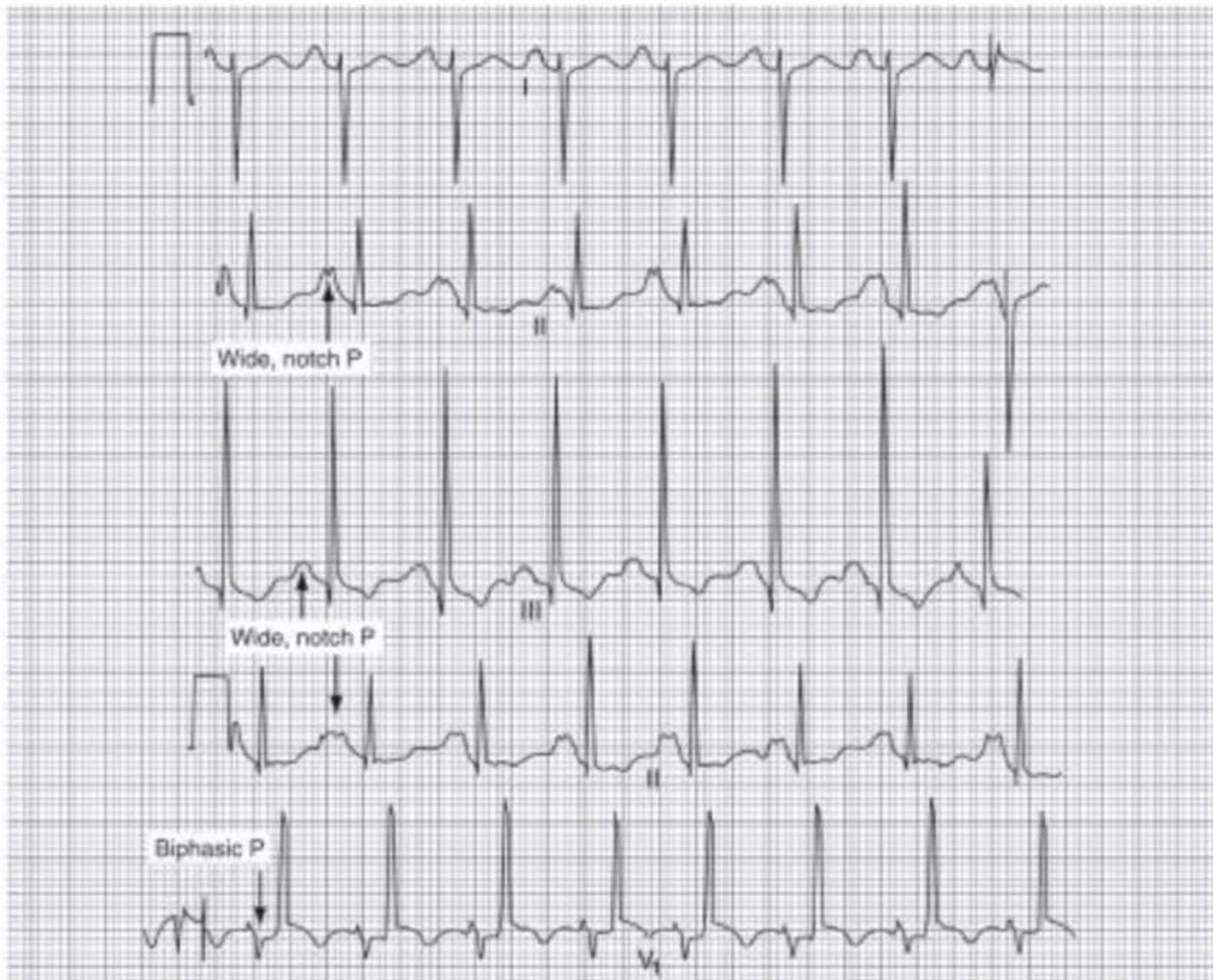
A: Echocardiogram (2D and M-mode).

Q: Mention five **causes**.

A: As follows:

- Chronic cor pulmonale.
- Mitral stenosis with pulmonary hypertension.
- Primary pulmonary hypertension.
- Pulmonary stenosis.
- Eisenmenger syndrome.
- Tetralogy of Fallot.

ECG 14: P MITRALE



P mitrale

Q: Write down three **abnormal findings** in this ECG.

A: As follows:

- P-wave is wide (> 0.12 seconds) in LII and III.
- P-wave is notched (or bifid) in LII (called P mitrale).
- P-wave in V1 is biphasic with prominent deep negative deflection (> 1 -mm depth) and small initial positive deflection.

Q: What is your **diagnosis**?

A: P mitrale.

Q: What does it **indicate**?

A: It indicates left atrial hypertrophy or enlargement.

Q: Mention two **causes** of such an ECG finding.

A: As follows:

- Mitral stenosis (commonest).
- Mitral regurgitation.

ECG 15: P PULMONALE



P pulmonale

Q: What is the **abnormal finding** in this ECG?

A: P-wave is tall (>2.5 mm) in LI, II and III (P pulmonale).

Q: What is your **diagnosis**?

A: P pulmonale.

Q: What does it **indicate**?

A: It indicates right atrial hypertrophy or enlargement.

Q: Mention five **causes** of such an ECG finding.

A: As follows:

- COPD with chronic cor pulmonale (commonest).
- Atrial septal defect.
- Tricuspid regurgitation or stenosis.
- Pulmonary stenosis.
- Pulmonary hypertension (as a result of any cause).

ECG 16: PULSUS BIGEMINY



Pulsus bigeminy

Q: What is the **abnormal finding** in this ECG?

A: Every normal beat is followed by a ventricular ectopic beat.

Q: What is your **diagnosis**?

A: Ventricular bigeminy.

Q: Mention five **causes**.

A: As follows:

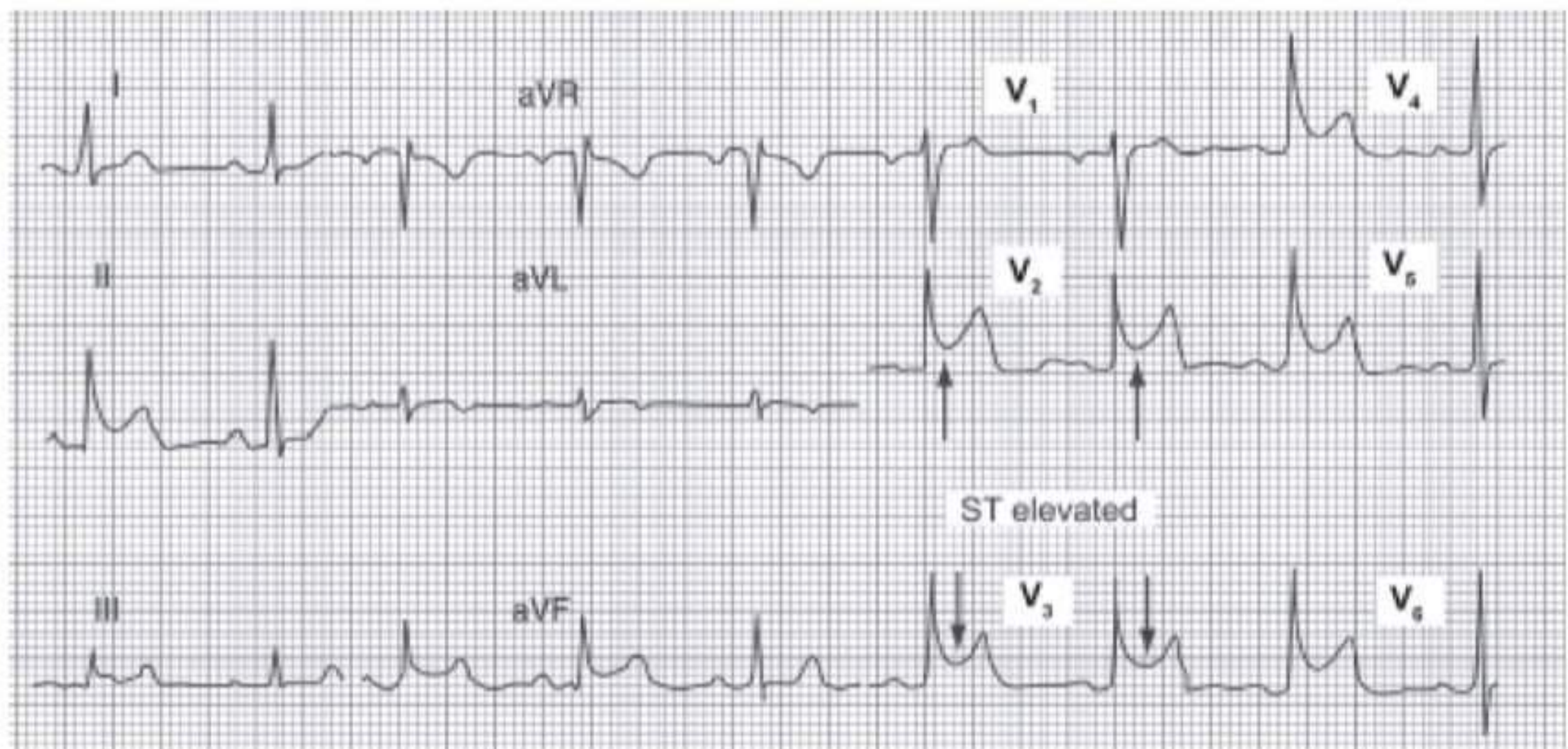
- Digoxin toxicity.
- Myocarditis.
- Cardiomyopathy.
- After acute myocardial infarction.
- Electrolyte imbalance (hypokalaemia).
- Hypoxaemia.

Q: How to **treat**?

A: As follows:

- Any offending drug should be stopped.
- Correction of electrolytes, especially hypokalaemia, hyperkalaemia and hypomagnesaemia.
- Treatment of primary cause or any organic heart disease.
- If asymptomatic: No other treatment.
- If symptomatic: β -Blocker (antiarrhythmic drugs should be avoided, as they may worsen the prognosis).

ECG 17: ACUTE PERICARDITIS



Acute pericarditis

Q: Mention the **abnormal finding**.

A: ST is elevated with upward concavity in LII, AVf, V2, V3, V4, V5 and V6.

Q: What is your **diagnosis**?

A: Acute pericarditis.

Q: Mention one **clinical finding**.

A: Pericardial rub.

Q: Mention five **causes**.

A: As follows:

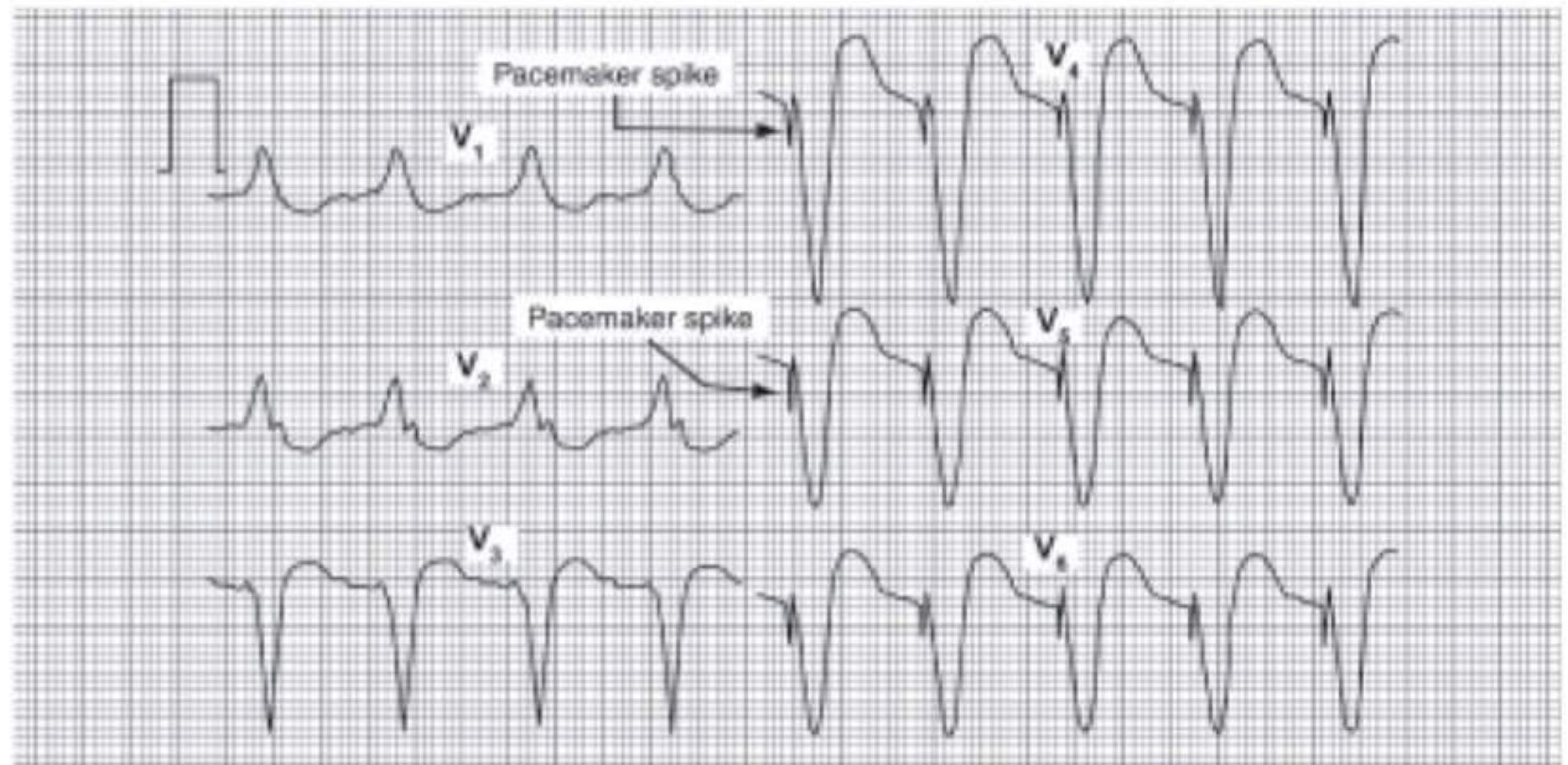
- Following acute myocardial infarction (usually on the second or third day).
- Infective: Viral (coxsackievirus B, echovirus) common cause. Others are bacterial (*Staphylococcus aureus*, *Haemophilus influenzae*), tuberculous pericarditis and fungal (histoplasmosis, coccidioidomycosis).
- Acute rheumatic fever.
- Acute renal failure.
- Malignancy (from carcinoma of bronchus, breast, lymphoma, leukaemia).
- Collagen disease (systemic lupus erythematosus [SLE], scleroderma).

Q: How to **treat**?

A: As follows:

- To relieve pain—nonsteroidal anti-inflammatory drug (NSAID) (indomethacin or ibuprofen or aspirin).
- In severe or recurrent case, corticosteroids should be given.
- If no response to steroid, azathioprine or colchicine may be given.
- If recurrence with no response to medical treatment, pericardiectomy may be done.
- Treatment of primary cause—antibiotic, if bacterial infection. Anti-Koch, if tuberculosis is suspected.

ECG 18: PACEMAKER



Ventricular pacemaker

Q: Mention two **abnormal findings**.

A: As follows:

- There is a spike, followed by a QRS complex.
- QRS complex is wide (looks like LBBB).

Q: What is your **diagnosis**?

A: Ventricular pacemaker.

Q: Mention two **absolute indications**.

A: As follows:

- Sick sinus syndrome.
- Stokes–Adams syndrome.

ECG 19: SINUS TACHYCARDIA



Sinus tachycardia

Q: Write down three important **findings** in this ECG.

A: As follows:

- Heart rate: 110/min.
- Rhythm: Normal.
- P-wave, QRS complex and T-wave: Normal.

Q: What is your **diagnosis**?

A: Sinus tachycardia.

Q: Write down five important **causes**.

A: As follows:

- Physiological: Anxiety, emotion, exercise, pain, pregnancy.
- Anaemia.
- Fever.
- Thyrotoxicosis.
- Shock (except vasovagal attack in which bradycardia is present).
- Heart failure.

N.B. Other causes are:

- *Chronic constrictive pericarditis.*
- *Acute anterior myocardial infarction (bradycardia is common in acute inferior myocardial infarction).*
- *Drugs (salbutamol, atropine, adrenaline, isoprenaline, ephedrine, propantheline, thyroxine).*

ECG 20: SINUS BRADYCARDIA



Sinus bradycardia

Q: Write down three important **findings** in this ECG.

A: As follows:

- Heart rate: 50/min.
- Rhythm: Regular.
- P-wave, QRS complex and T-wave: Normal.

Q: What is your **diagnosis**?

A: Sinus bradycardia.

Q: Write down five important **causes**.

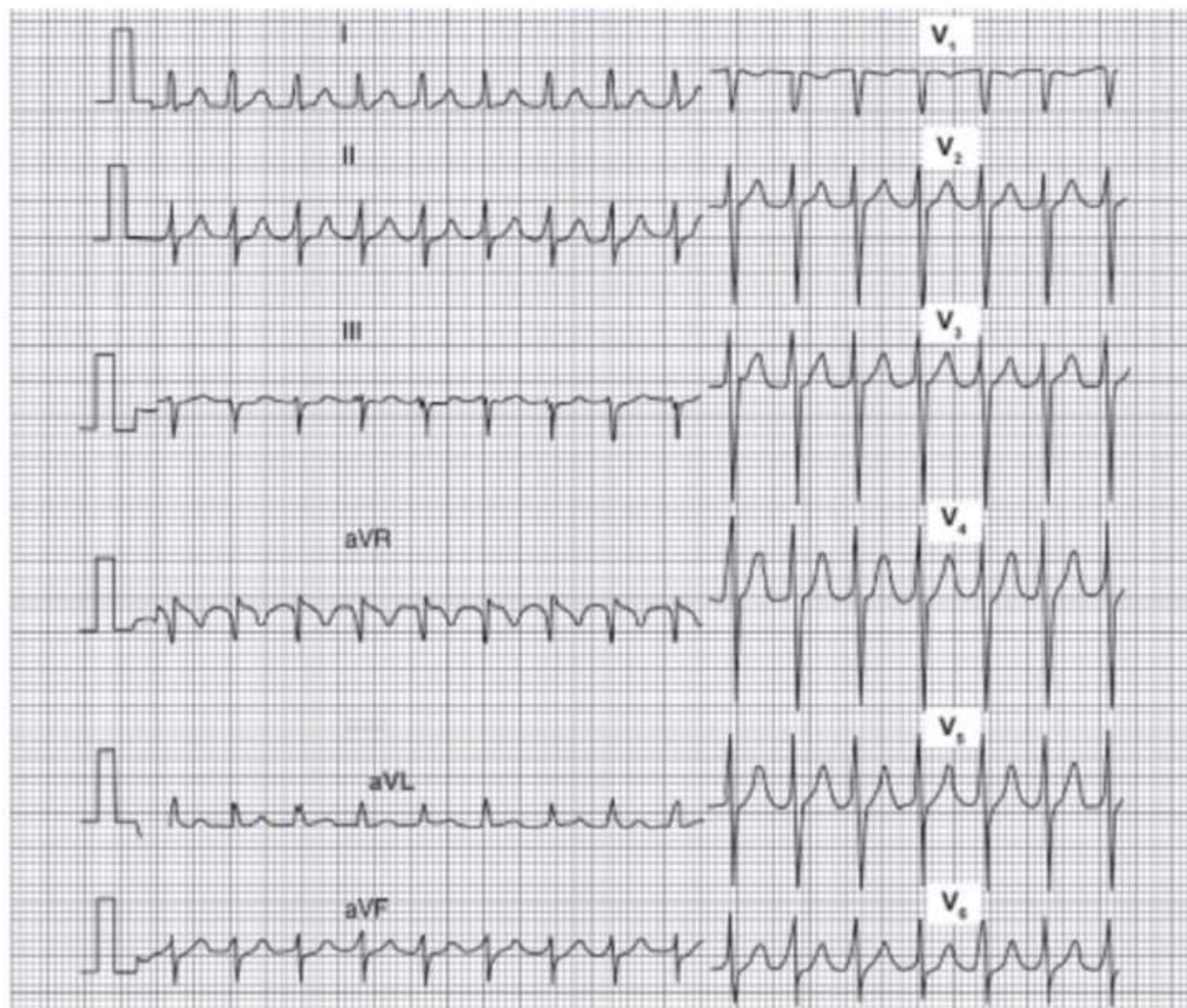
A: As follows:

- Physiological: In athletes, during sleep.
- Hypothyroidism.
- Hypothermia.
- Raised intracranial pressure (as a result of inhibitory effect on sympathetic outflow).
- Drugs (digoxin, β -blockers, verapamil).

N.B. Other causes are:

- Acute inferior myocardial infarction.
- Obstructive jaundice (as a result of deposition of bilirubin in the conducting system).
- Electrolyte imbalance (hypokalaemia).
- Neurally mediated syndromes as a result of a reflex (Bezold–Jarisch), which causes bradycardia and reflex peripheral vasodilatation. These are carotid sinus syndrome, neurocardiogenic (vasovagal) syncope (syndrome), which presents as syncope or presyncope.

ECG 21: SUPRAVENTRICULAR TACHYCARDIA



Supraventricular tachycardia

Q: Write down four important **findings** in this ECG.

A: As follows:

- Heart rate: 140/min.
- Rhythm: Regular.
- P-wave: Absent.
- QRS complex: Narrow.

Q: What is your **diagnosis**?

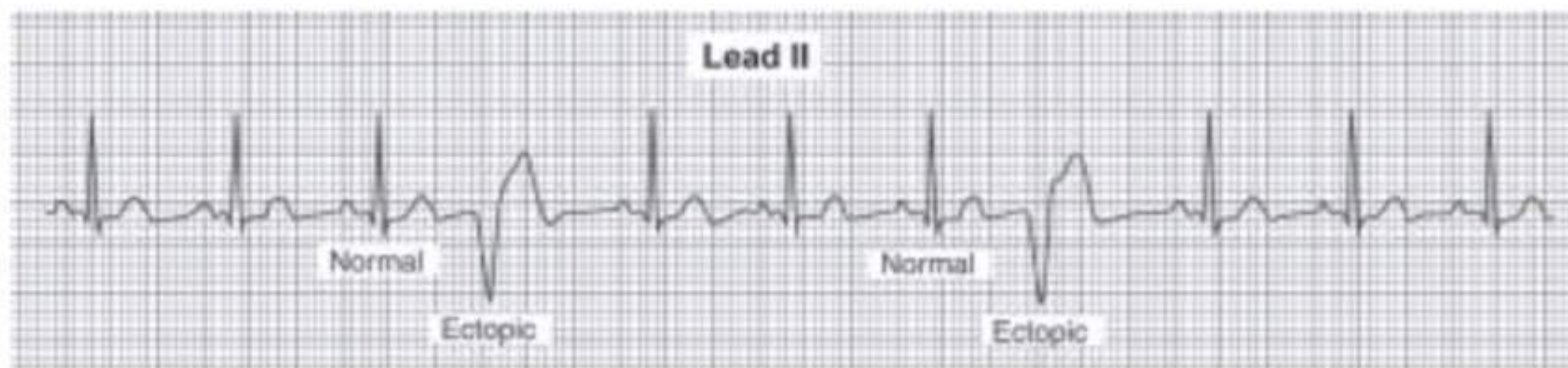
A: Supraventricular tachycardia.

Q: Write down five important **causes**.

A: As follows:

- Physiological: Anxiety, tea, coffee, alcohol.
- Thyrotoxicosis.
- Ischaemic heart disease.
- WPW syndrome.
- Digitalis toxicity.

ECG 22: VENTRICULAR PREMATURE BEAT



Ventricular premature beat

Q: Write down three important **findings** in this ECG.

A: There are two ventricular premature beats with the following characteristics:

- P: Absent.
- QRS complex: Wide >0.12 seconds (three small squares).
- T: Opposite to major deflection.

Q: What is your **diagnosis**?

A: Ventricular premature (ectopic) beats.

Q: Write down five important **causes**.

A: As follows:

- Normally in young adults, as well as in anxiety, excess caffeine, alcohol.
- Acute myocardial infarction.
- Myocarditis.
- Cardiomyopathy.
- Electrolyte imbalance (especially hypokalaemia).
- Digoxin toxicity.
- Mitral valve prolapse.

Q: What are the **types**?

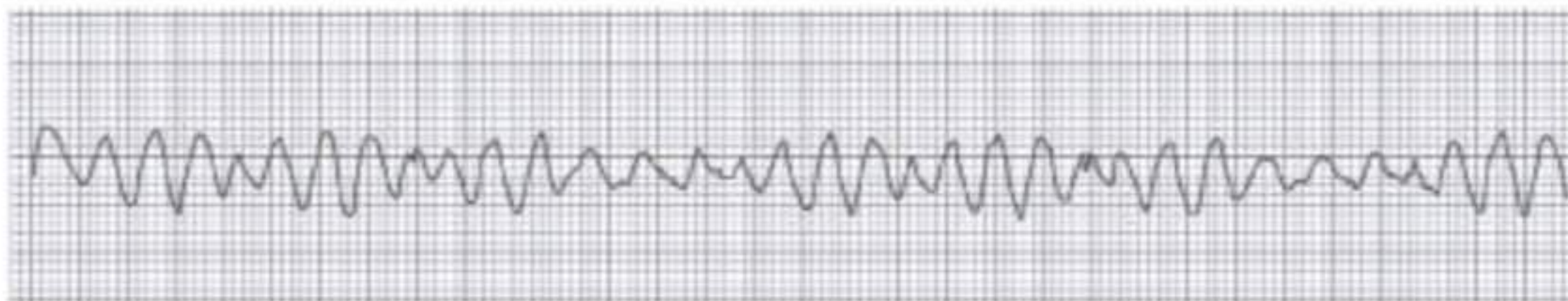
A: As follows:

- *Unifocal*: Similar configuration of ectopics in all leads; it originates from a single ectopic ventricular focus.
- *Multifocal*: Variable configuration of ectopics in the same lead; ectopics originate from different foci of the ventricle.
- *Interpolated ventricular ectopics*: It means when ventricular ectopics occur between two normal sinus beats without a compensatory pause.

Other Types

- *Couplet*: Two ventricular ectopics in a row, multifocal.
- *Triplet*: Three ventricular ectopics in a row (runs of ectopic, three or more ventricular ectopics in a row, may be taken as ventricular tachycardia).
- *Ventricular bigeminy*: Every one normal beat, followed by ventricular ectopic.

ECG 23: VENTRICULAR FIBRILLATION



Ventricular fibrillation

Q: What is the **finding** in this ECG.

A: QRS complex: Chaotic, wide, bizarre, irregular.

Q: What is your **diagnosis**?

A: Ventricular fibrillation.

Q: Write down five important **causes**.

A: As follows:

- Acute myocardial infarction.
- Electrolyte imbalance (hypokalaemia, hypomagnesaemia).
- Electrocution.
- Drowning.
- Drug overdose (digitalis, adrenaline, isoprenaline).

Q: Mention six clinical **signs** in this patient.

A: As follows:

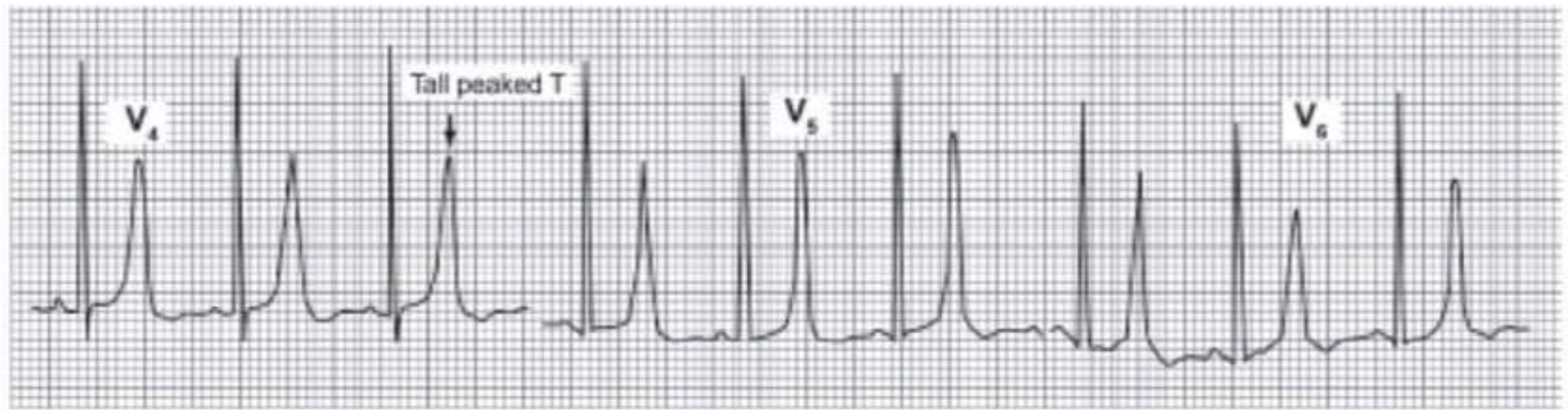
- Pulse: Absent.
- Blood pressure (BP): Not recordable.
- Respiration: Ceases or absent.
- Patient: Unconscious.
- Pupil: Dilated, less or no reaction to light.
- Heart sounds: Absent.

Q: How to **treat**?

A: As follows:

- Immediate defibrillation: 200 Joules. If no response, another shock with 200 Joules is given. If still no response, another shock with 360 Joules is given.
- If three shocks unsuccessful: Adrenaline is given intravenously, followed by cardiopulmonary resuscitation.
- If defibrillator is not available, cardiopulmonary resuscitation should be given.
- The patient who survives ventricular fibrillation in the absence of identifiable cause is at a high risk of sudden death. This case is treated with implantable cardioverter defibrillator.

ECG 24: HYPERKALAEMIA



Hyperkalaemia

Q: Write down two important **findings** in this ECG.

A: As follows:

- T-wave: Tall, peaked and tented.
- P-wave: Wide and small.

N.B. Other probable findings are (not seen in this ECG):

- *P-R interval: Prolonged.*
- *QRS complex: Wide, slurred and bizarre.*

Q: What is your **diagnosis**?

A: Hyperkalaemia.

Q: Write down four important **causes**.

A: As follows:

1. High potassium intake.
2. Renal diseases:
 - Acute and chronic renal failure.
 - Impaired tubular secretion of K^+ (renal lupus, amyloidosis, transplanted kidney).
3. Endocrine diseases:
 - Addison disease.
 - Diabetic ketoacidosis.
 - Primary hypoaldosteronism.
4. Drugs: Potassium-sparing diuretics (spironolactone, amiloride, triamterene), angiotensin-converting-enzyme (ACE) inhibitor, NSAID, cyclosporine.

Q: Write four clinical **features**.

A: As follows:

- Muscular weakness; it may be severe, causing flaccid paralysis, loss of tendon jerk.
- Paralytic ileus (abdomen may be distended).
- Tingling around the lip or finger.
- Sudden death as a result of cardiac arrest or arrhythmia.