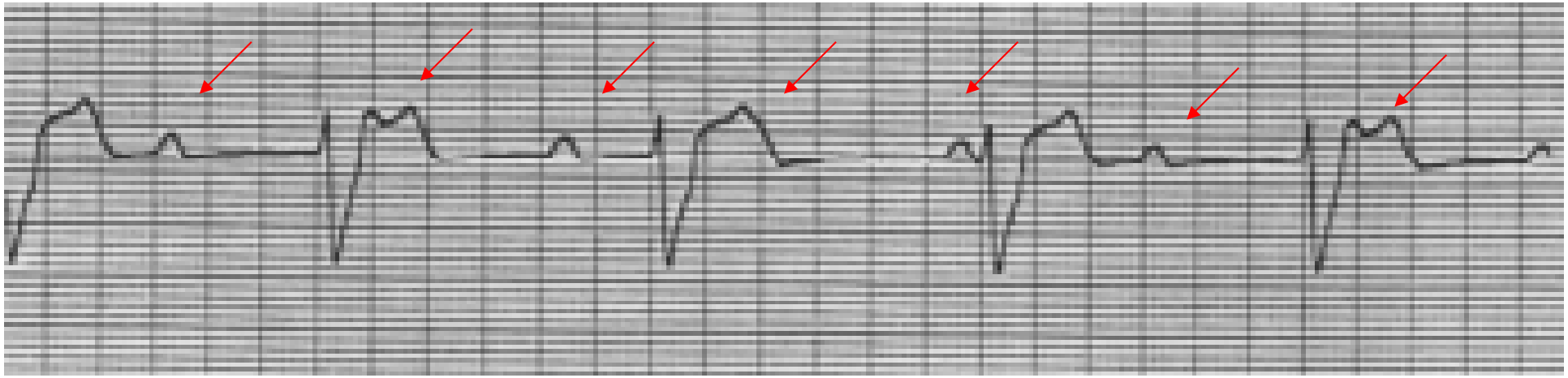
Sample

Sample 1

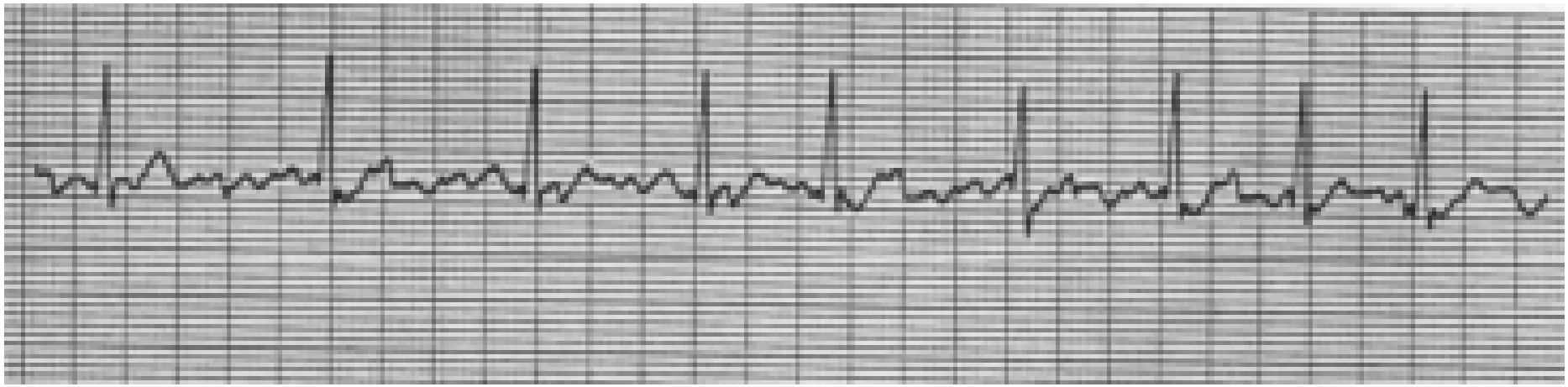


QRS: rate ~50 bpm, wide QRS, regular

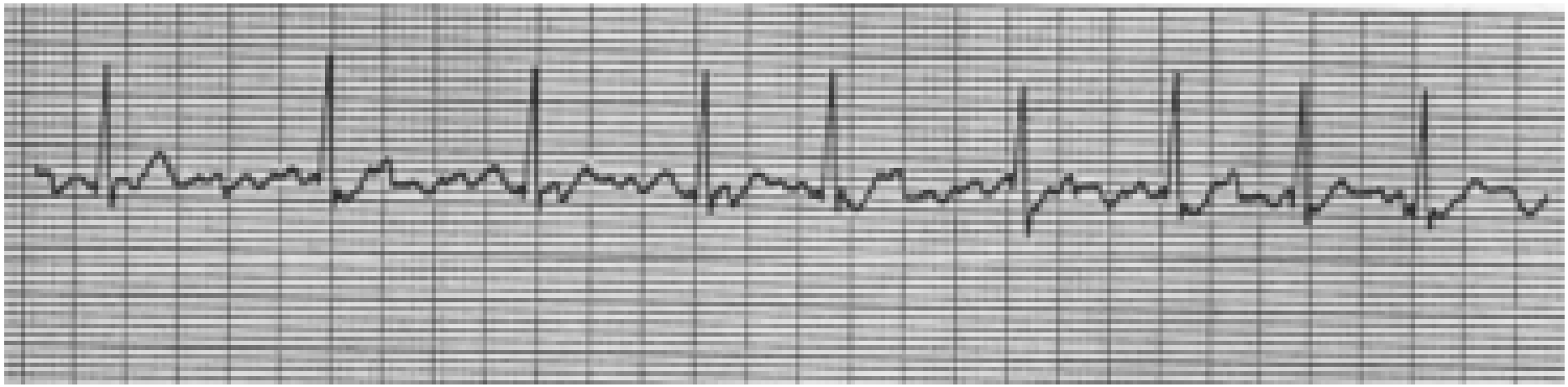
P wave > QRS

PR – not consistent (no association)

Sample 2



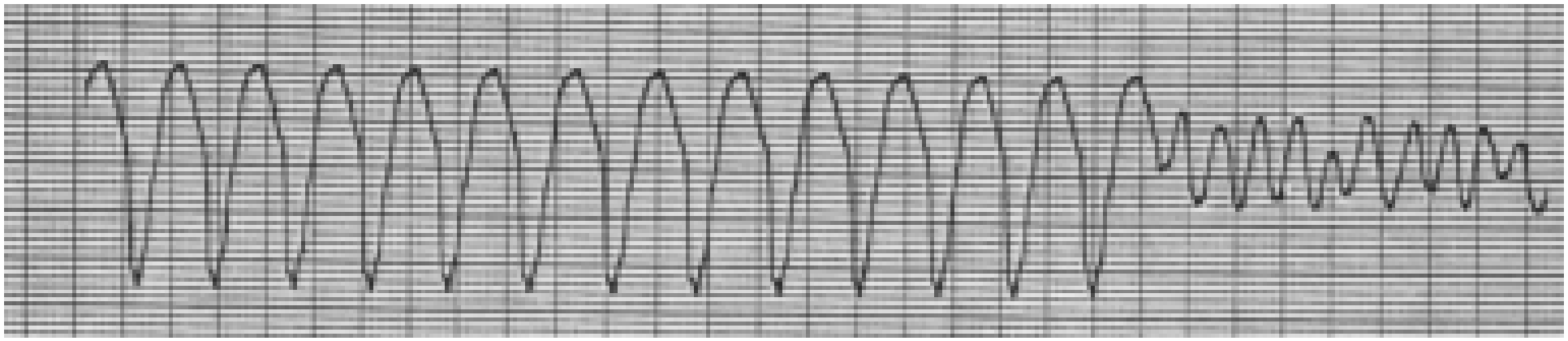
Sample 2



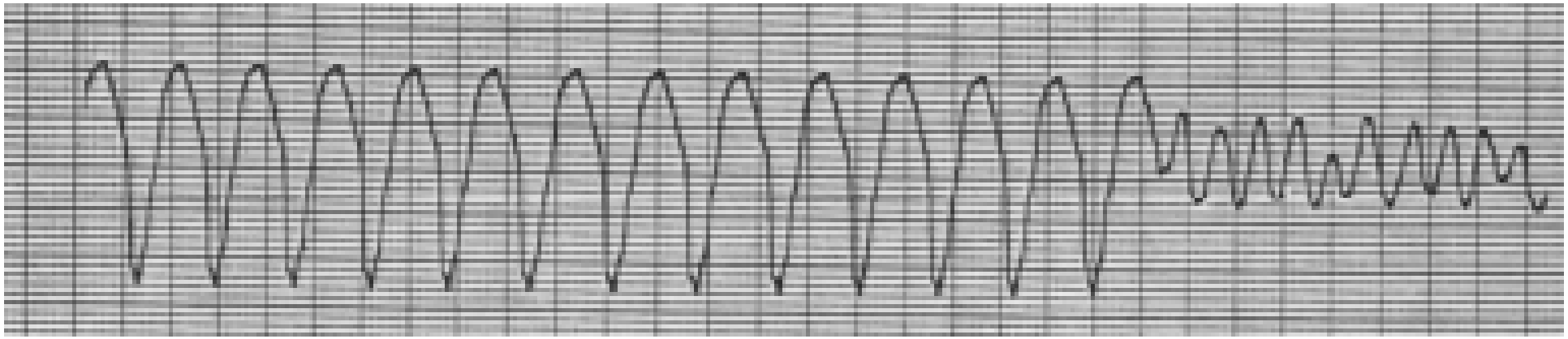
QRS : rate ~ 90-100, narrow, irregular

P wave : not identified, coarse fibrillation wave

Sample 3



Sample 3

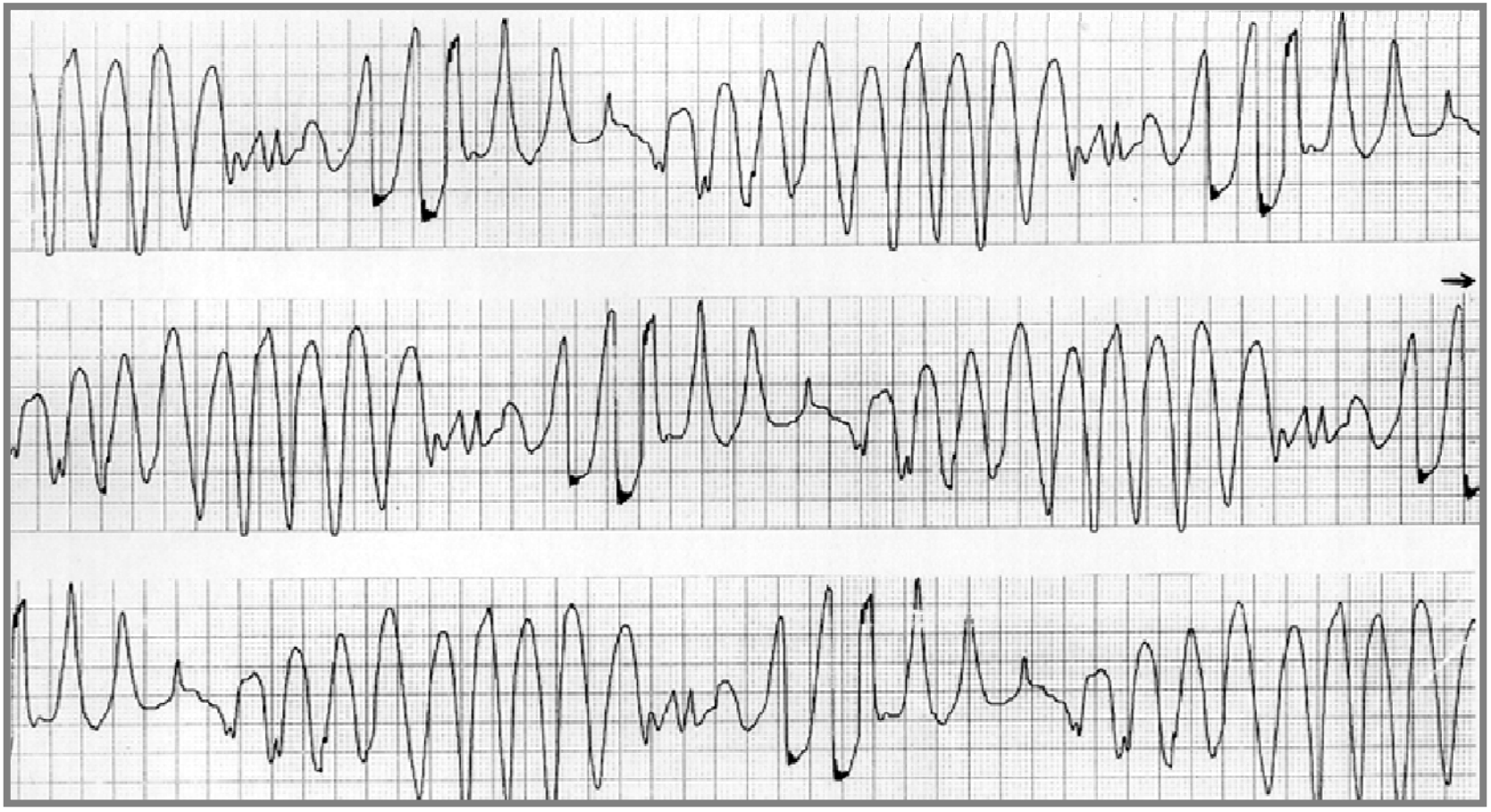


QRS : initial part – wide QRS, rate ~ 150 bpm

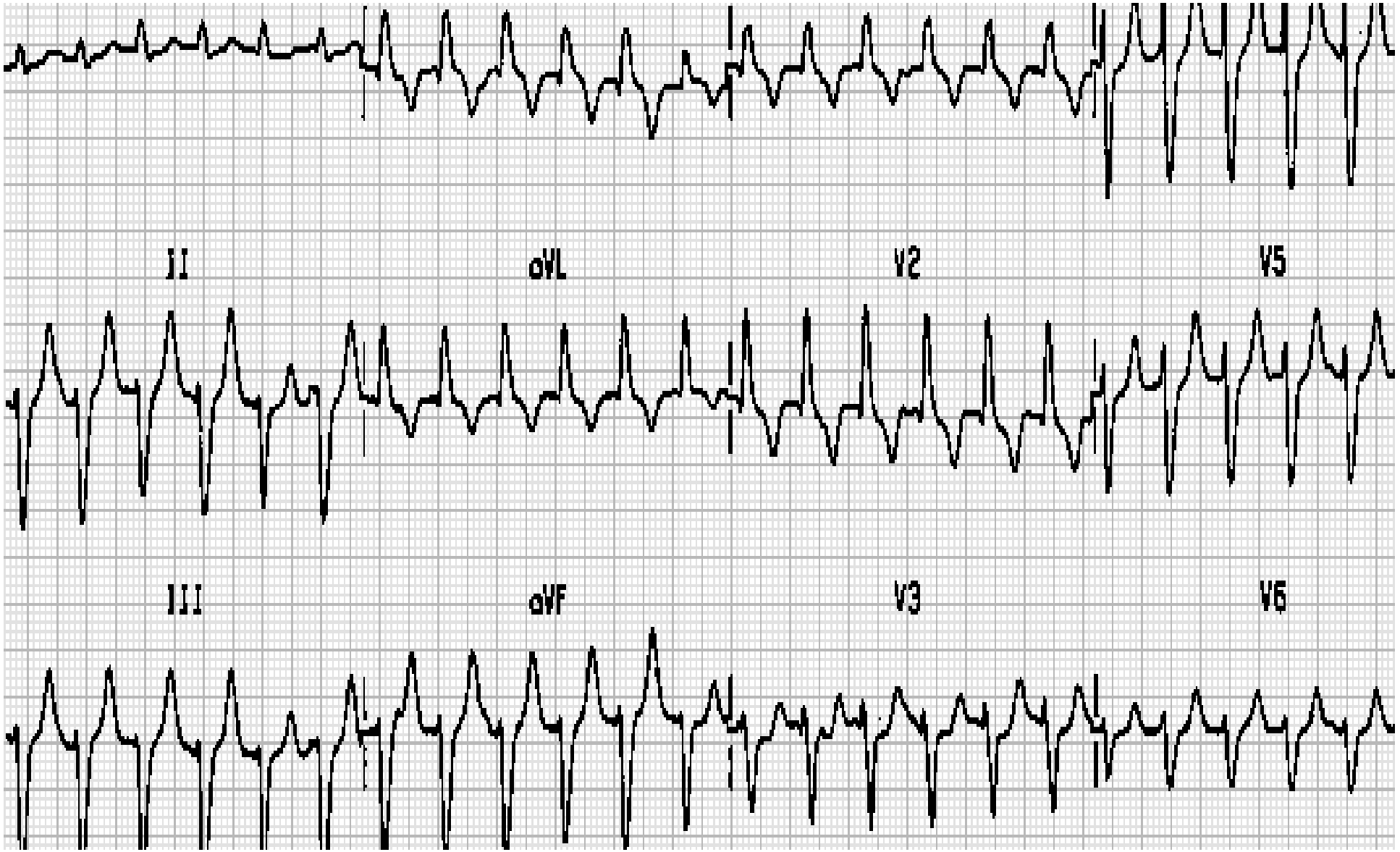
latter part – non-identifed, fibrillation wave

P wave: not clearly seen

Sample 4



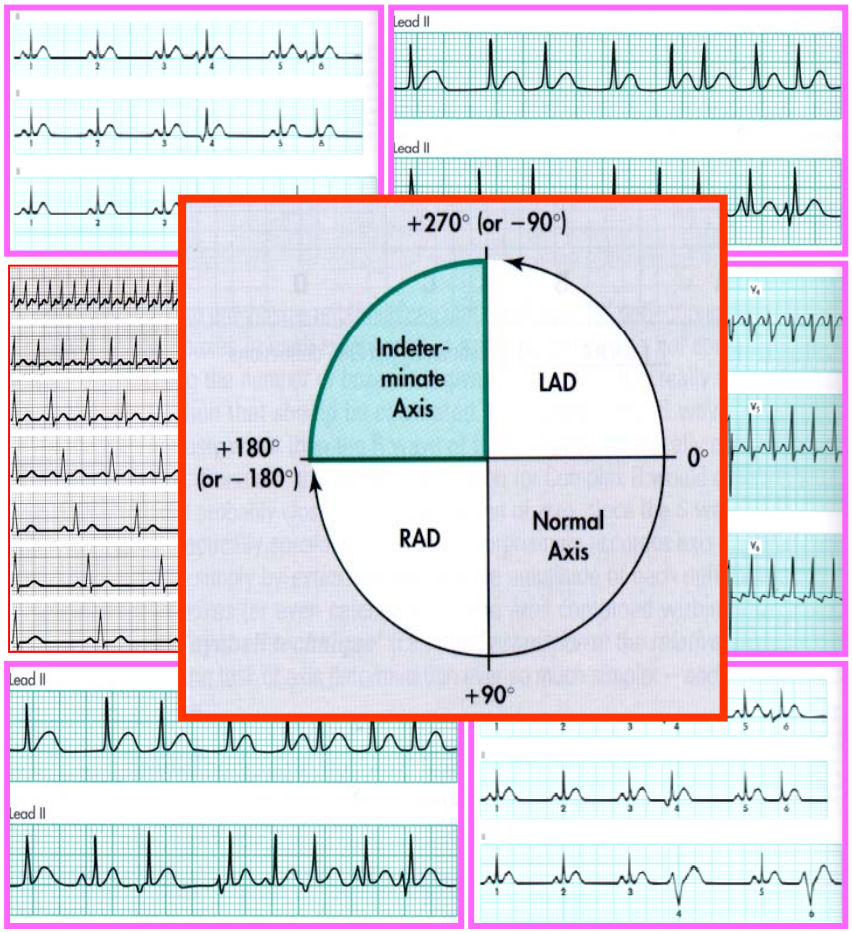
Sample 5



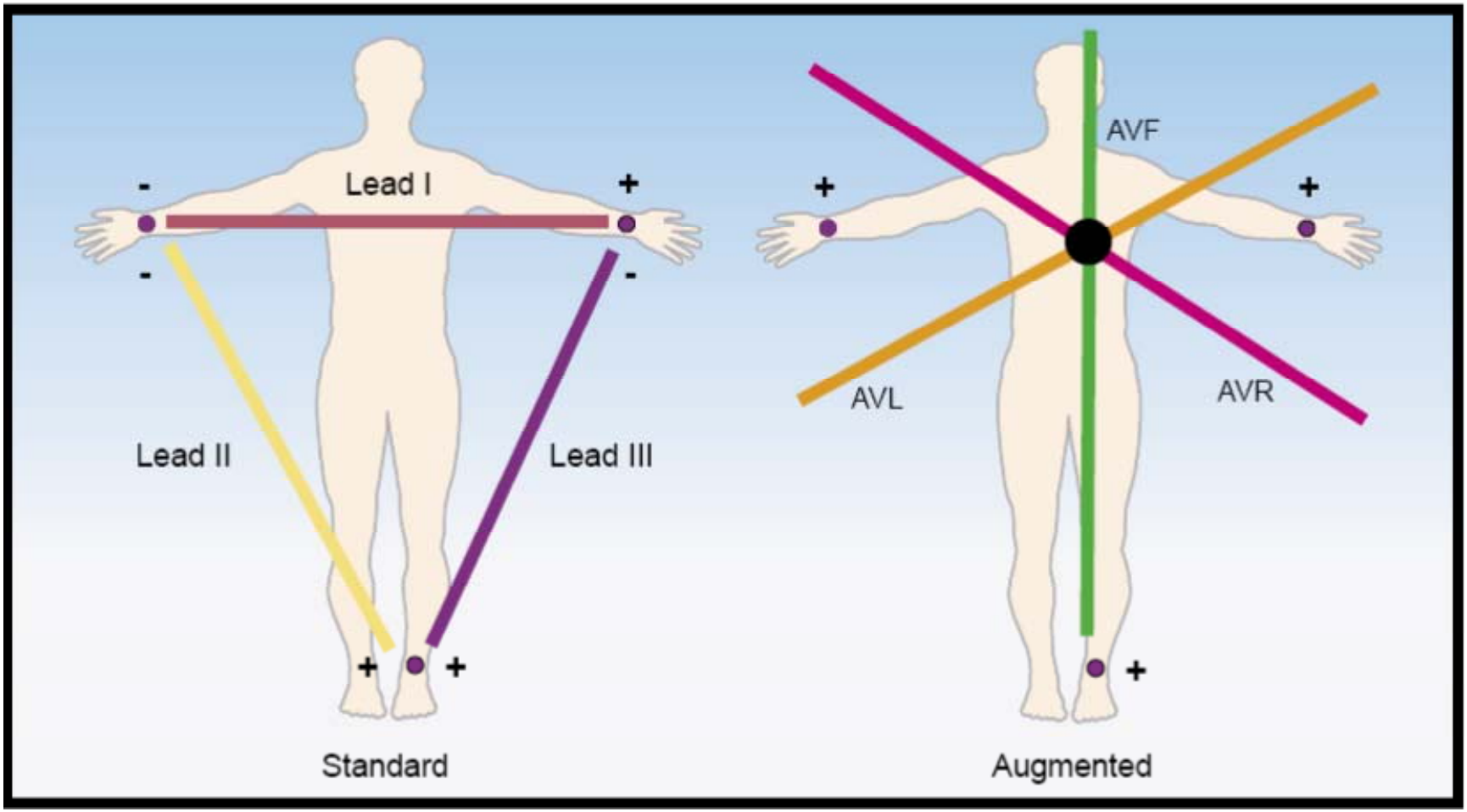
12-lead ECG

Five Aspects for ECG Reading

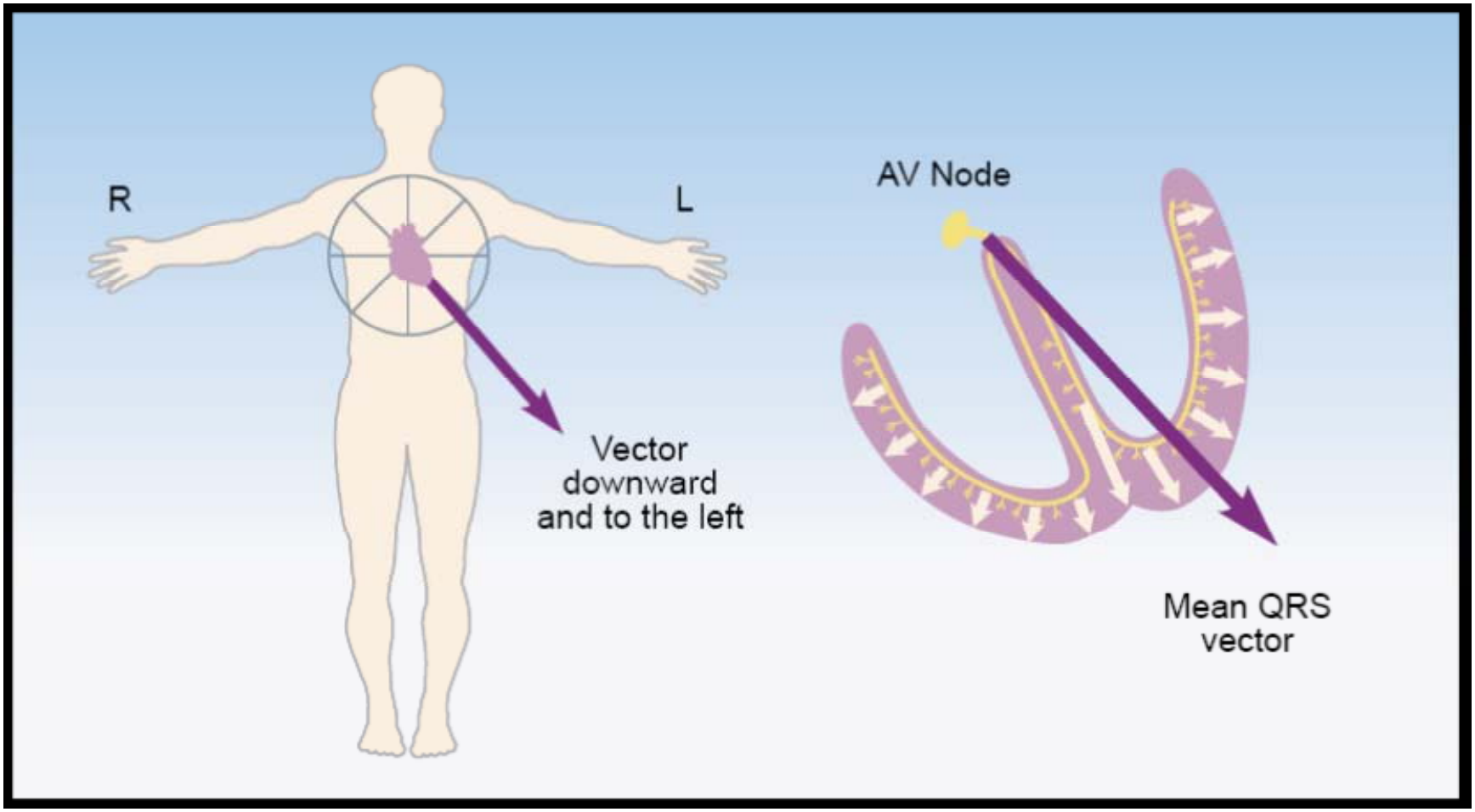
- Rate
- Rhythm
- **Axis**
- Hypertrophy
- Infarction



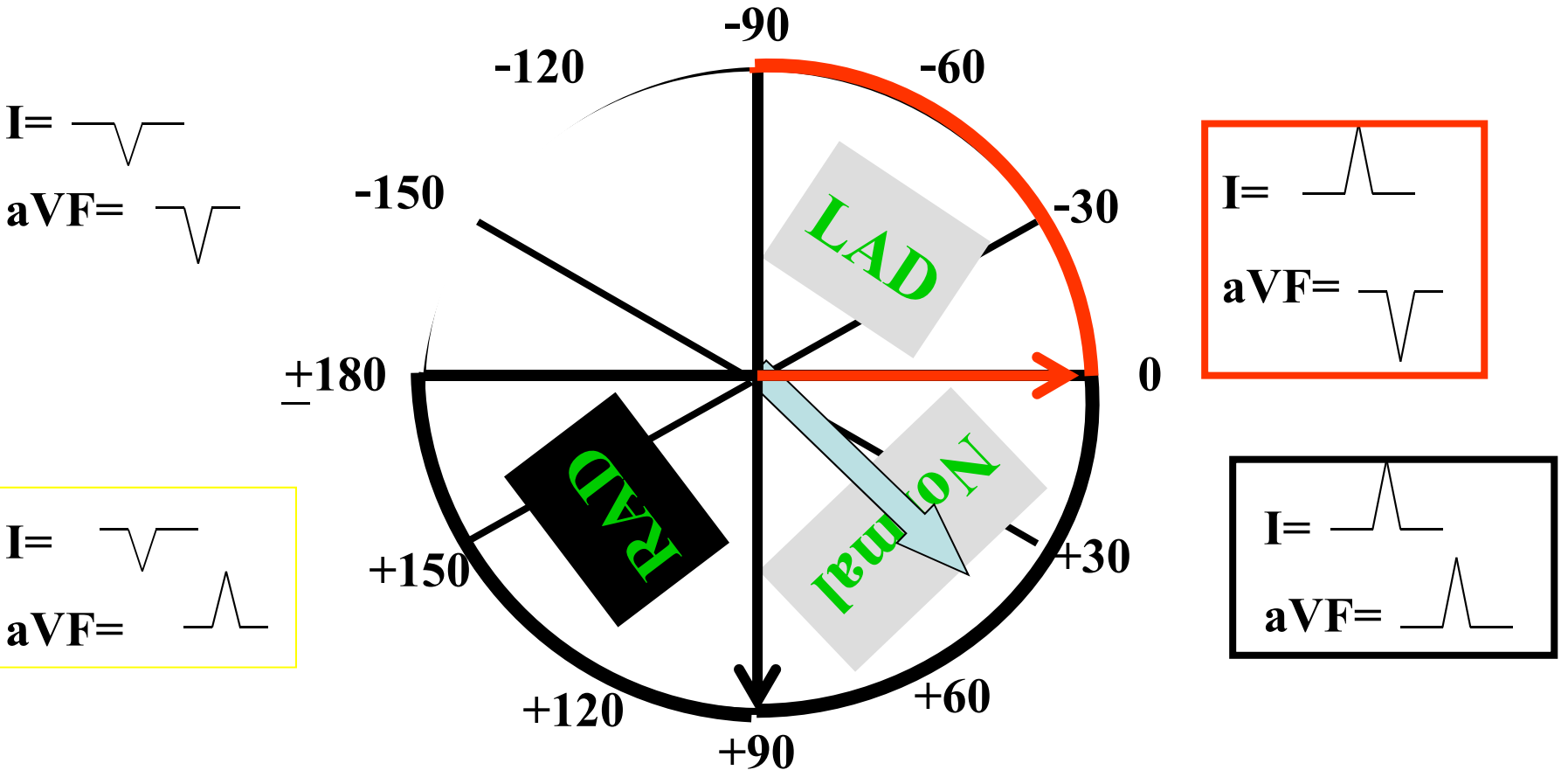
Limb Leads



QRS vector



Cardiac Axis

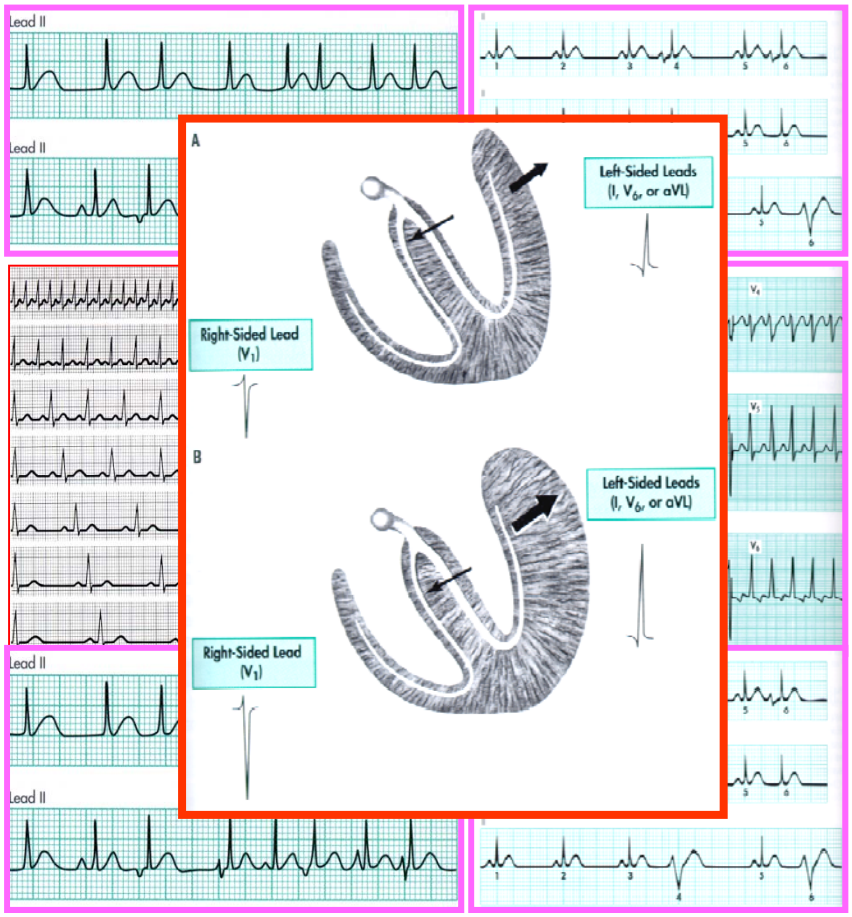


Axis deviation (Frontal plane)

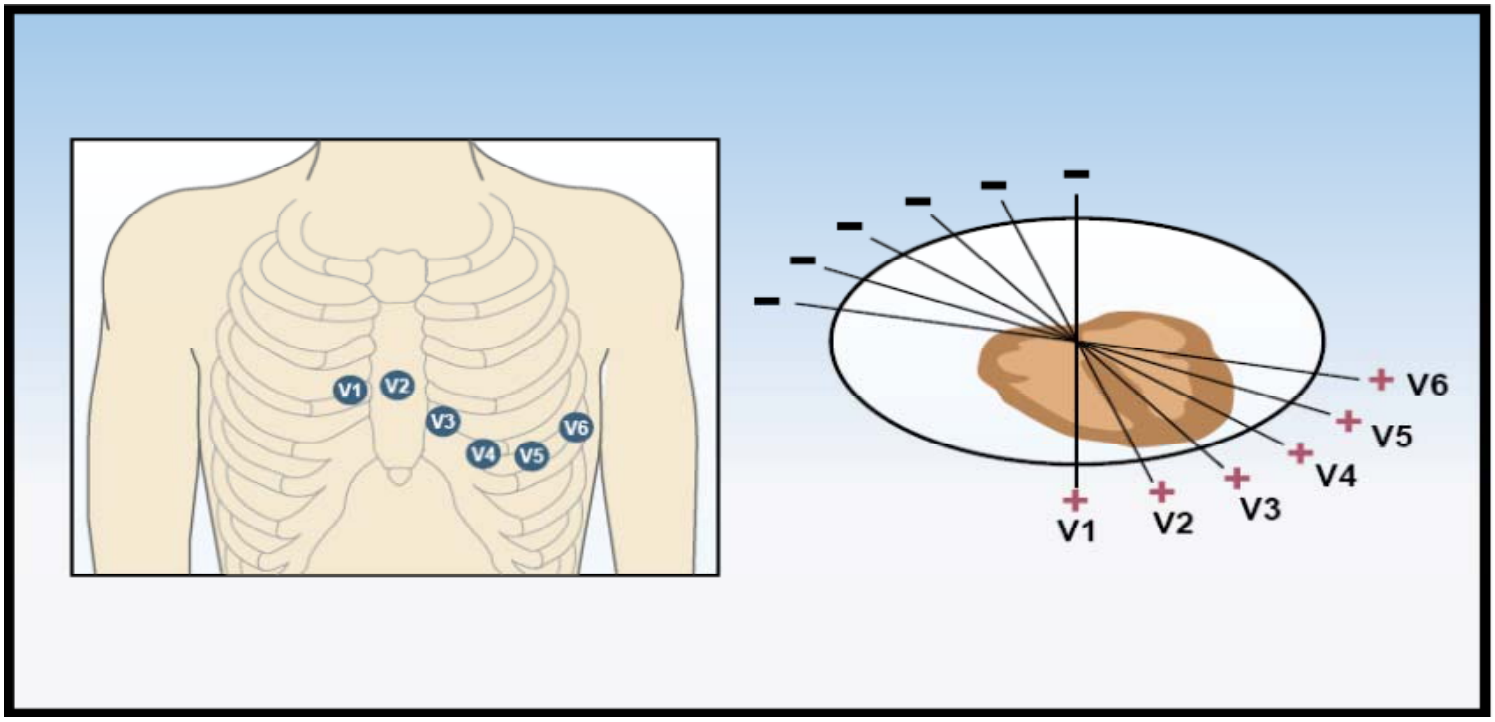
- **Right axis deviation**
  - Adolescent (90º–120º)
  - Normal variant
  - RVH
  - Dextrocardia
  - Pulmonary embolism
  - Cor-pulmonale
  - LPHB
  - Anterolateral or lateral MI
- Left axis deviation
  - Pregnancy
  - Obese
  - Old age
  - LVH
  - LBBB
  - LAHB
  - Cardiac pacing
  - Pre-excitation
  - ASD, primum

Five Aspects for ECG Reading

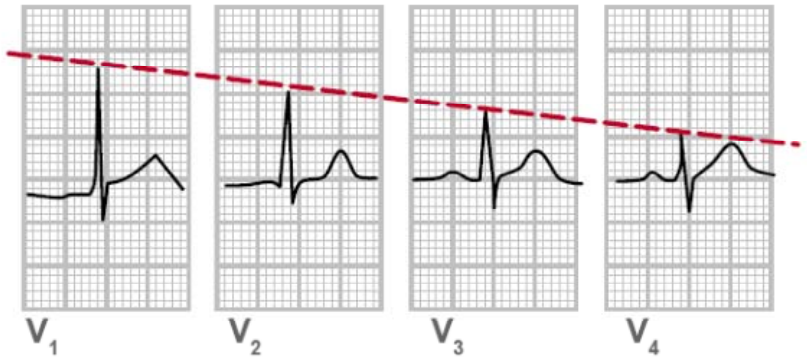
- Rate
- Rhythm
- Axis
- **Hypertrophy**
- Infarction



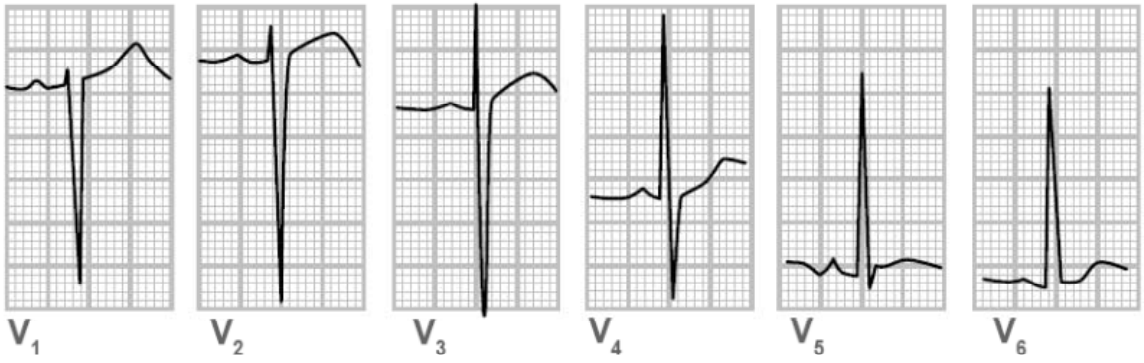
Chest Leads



Ventricular Hypertrophy



Right ventricular hypertrophy (RV)

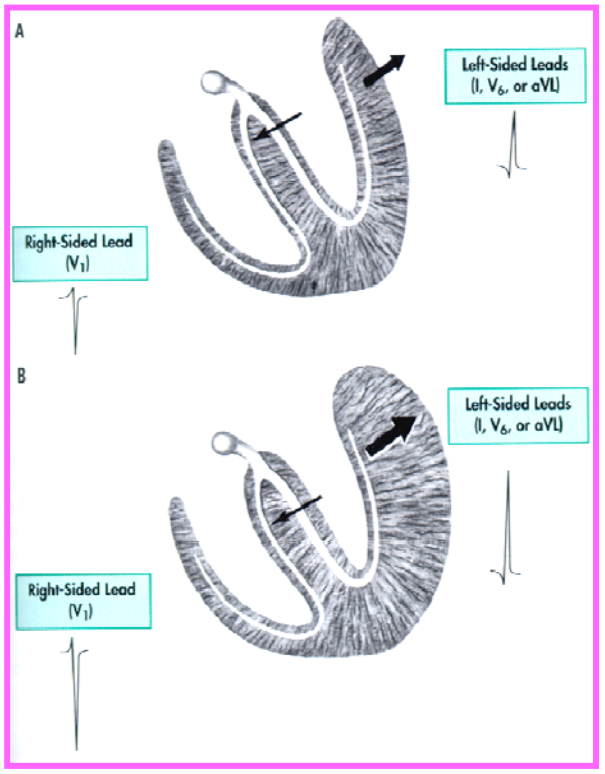


ECG diagnosis of LVH

1. **Deepest S wave in lead V_1 or V_2 , plus**

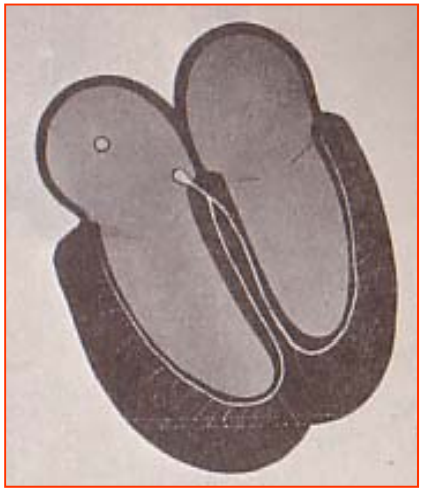
   tallest R wave in lead V_5 or V_6 > 35

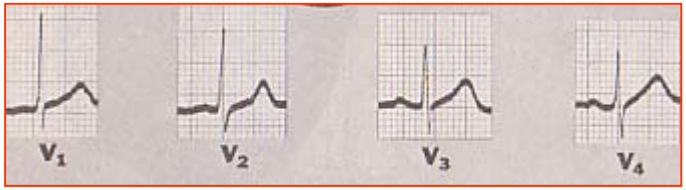
2. **R in lead aVL >** 12
3. **Patient >** 35 **years old**
4. **“Strain ”**



Findings suggestive of RVH

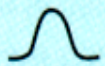
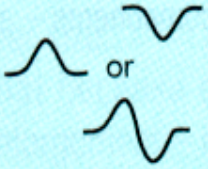
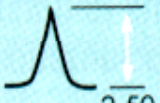
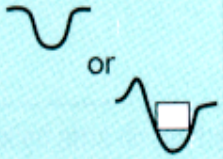
1. **RAD or indeterminate axis**
2. **R > S in V_1**
3. **R wave gets progressively smaller from V_1 to V_6**
4. **Persistent precordial S waves (in V_5 and V_6)**
5. **Wide QRS complex**





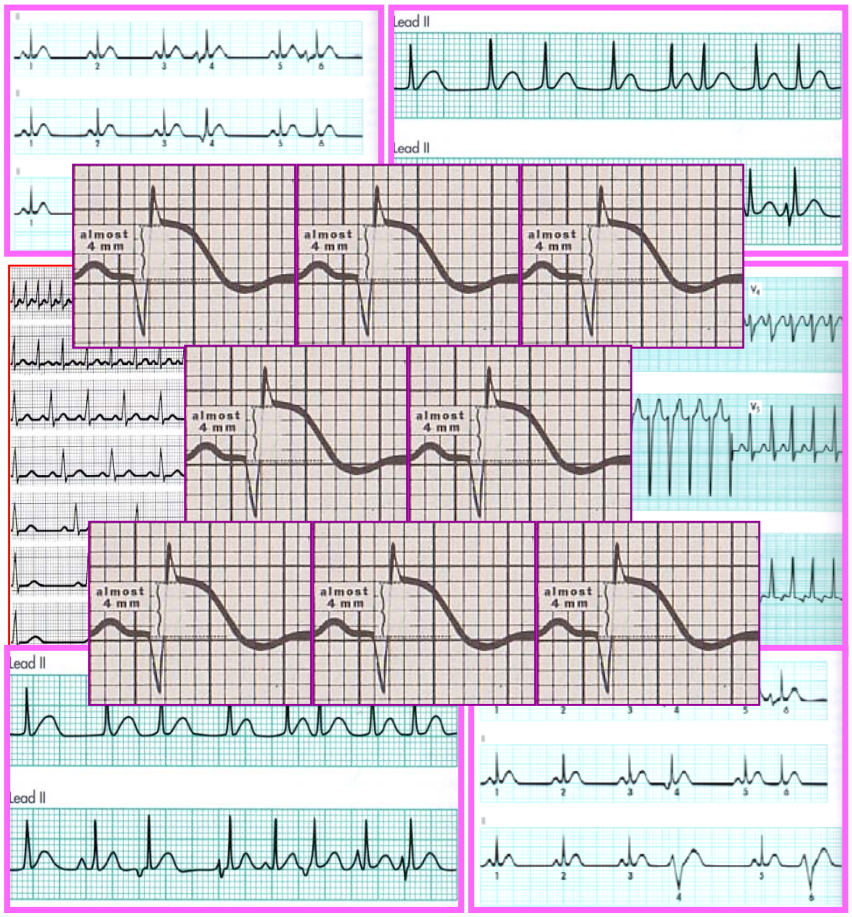
V_1

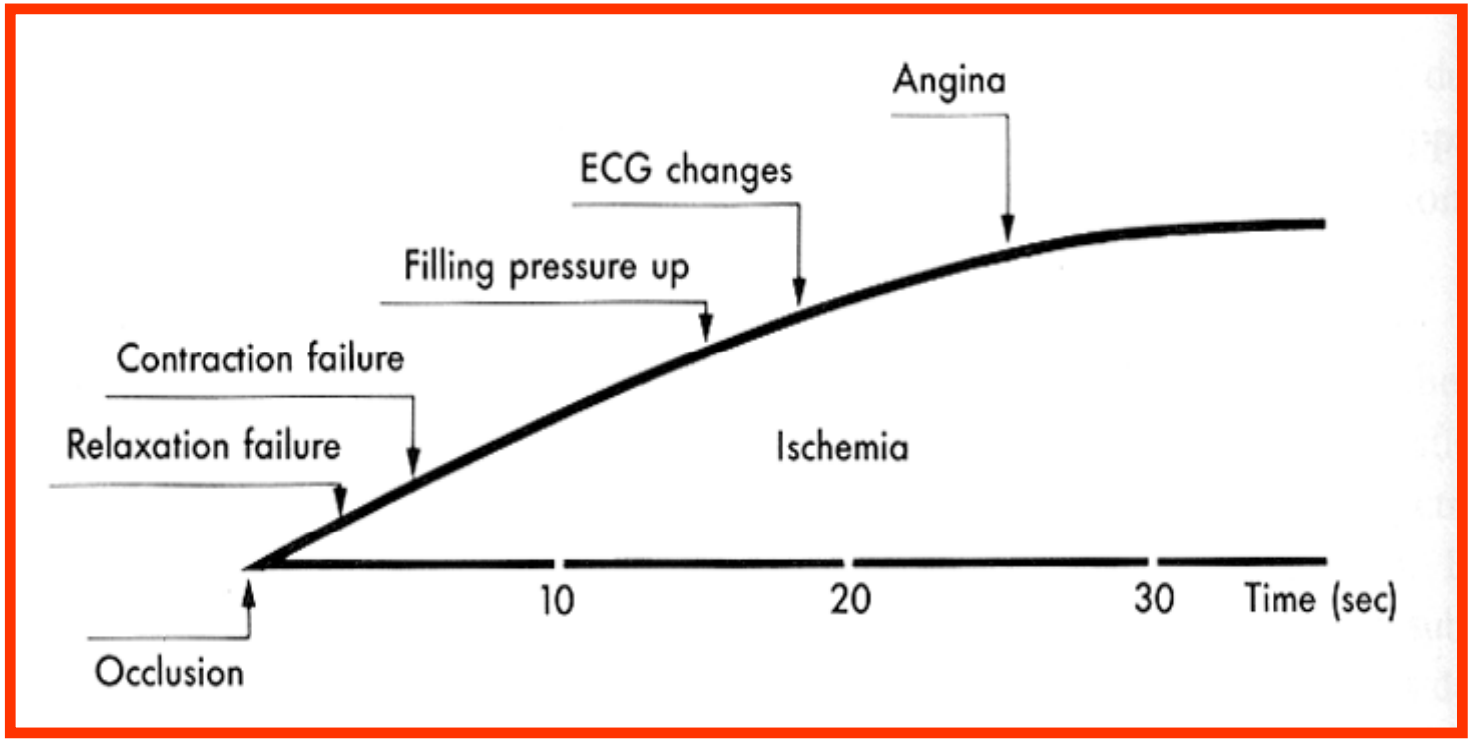
ECG diagnosis of RAE and LAE

Condition	P Wave Appearance		Mnemonic Features
	Lead II	Lead V_1	
Normal Sinus Rhythm (NSR)			• The P should be upright in Lead II if there is sinus rhythm • The P may be upright, negative or biphasic in Lead V_1 with sinus rhythm
RAA (=**P** **P**ulmonale)			• **P**rominent (≥ 2.5 mm tall) **p**eaked P waves in the **p**ulmonary leads (II, III, and aVF)
LAA (=P **M**itrale)			• **M**-shaped, widened (≥ 0.12 sec) P waves in one or more of the **m**itral leads (I, II, or aVL) • Deep, negative component to the P wave in lead V_1

Five Aspects for ECG Reading

- Rate
- Rhythm
- Axis
- Hypertrophy
- **Infarction**



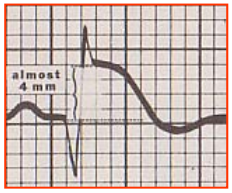

Angina
ECG changes
Filling pressure up
Contraction failure
Relaxation failure
Ischemia
10
20
30
Time (sec)
Occlusion

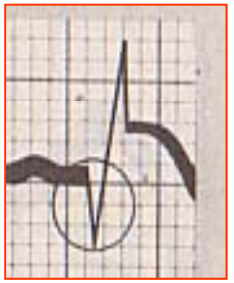
Myocardial Infarction

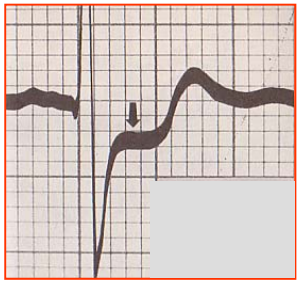
A. Injury = ST Segment Elevation

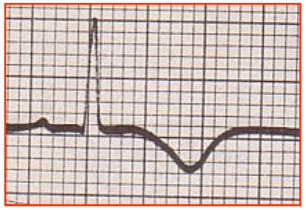
B. Infarction = Q Wave, subendocardium

C. Ischemia = T Wave Invertion

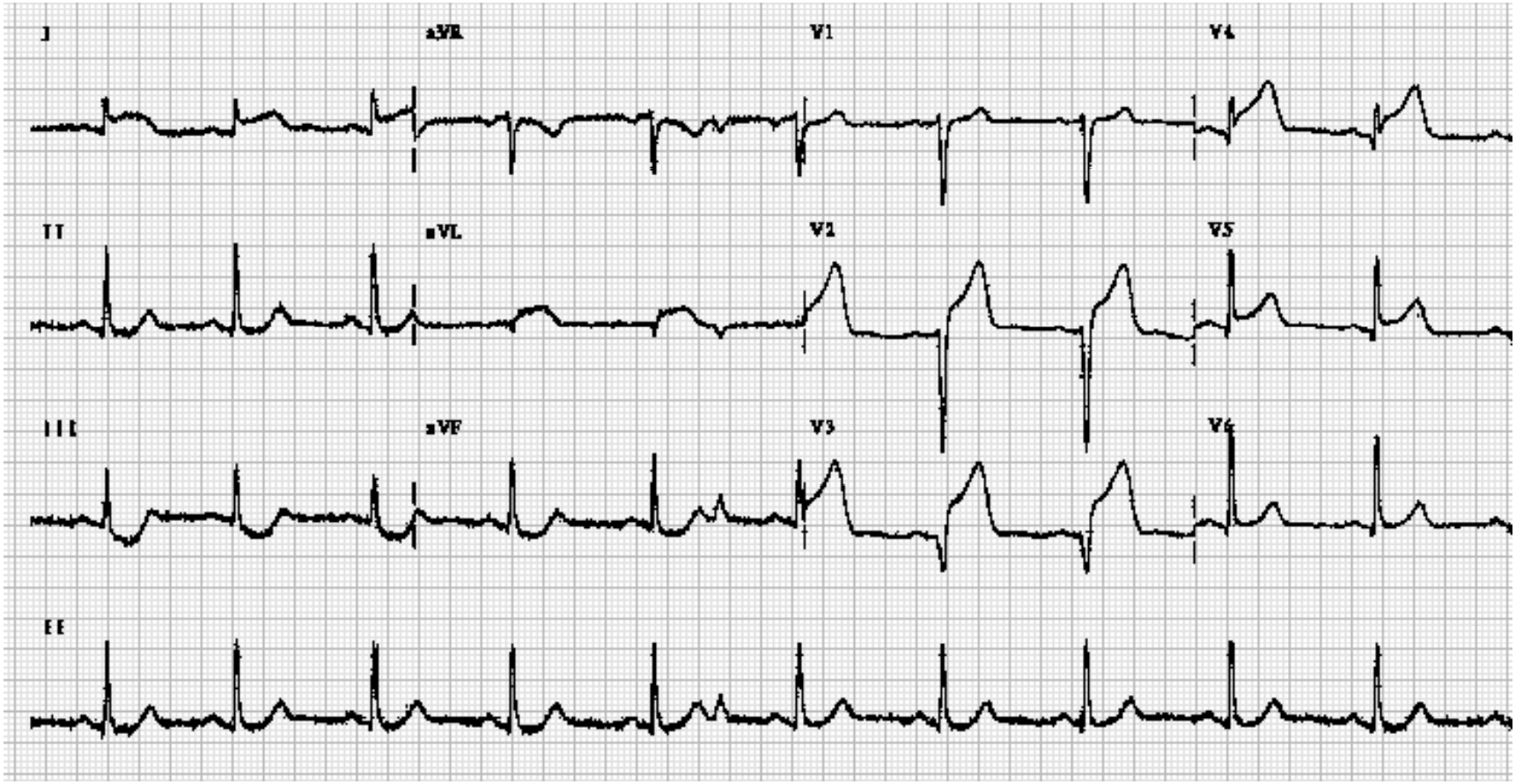


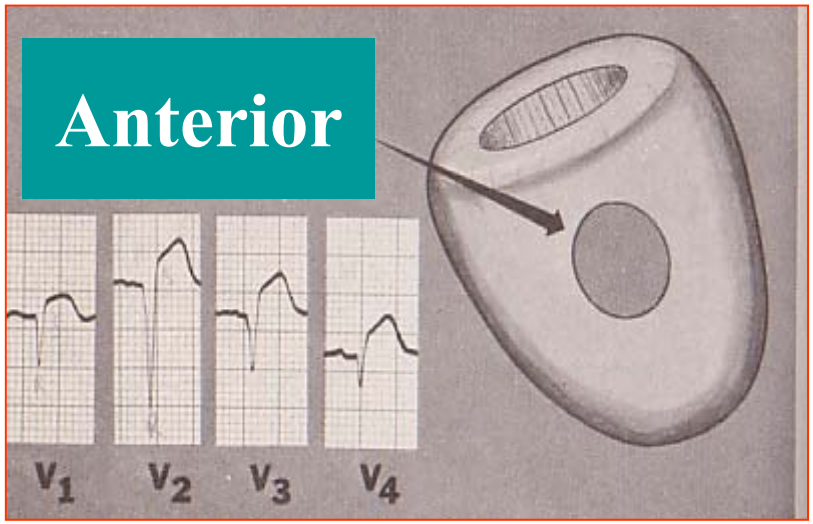


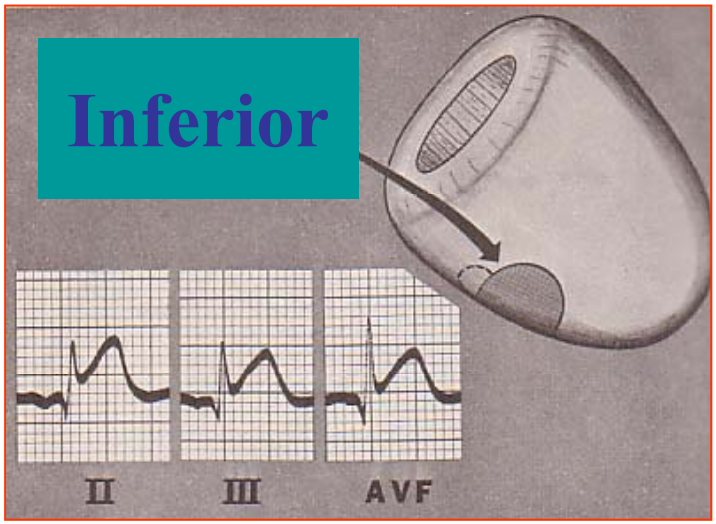


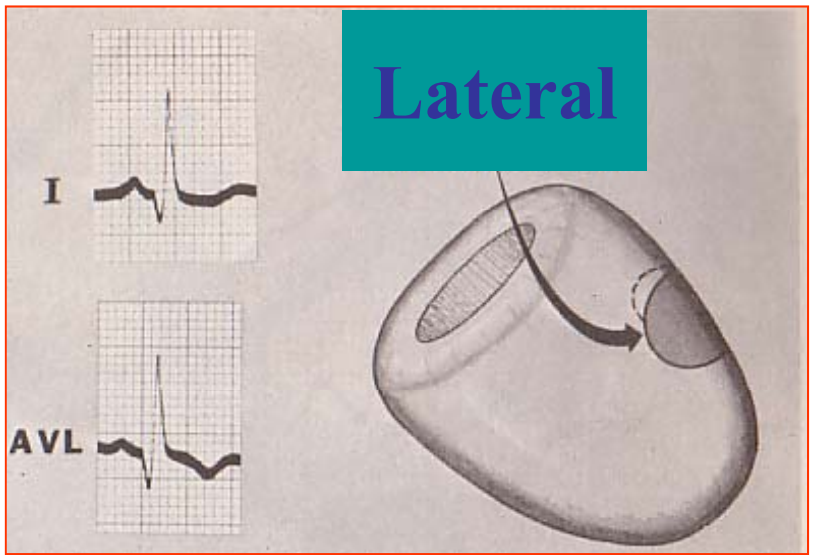


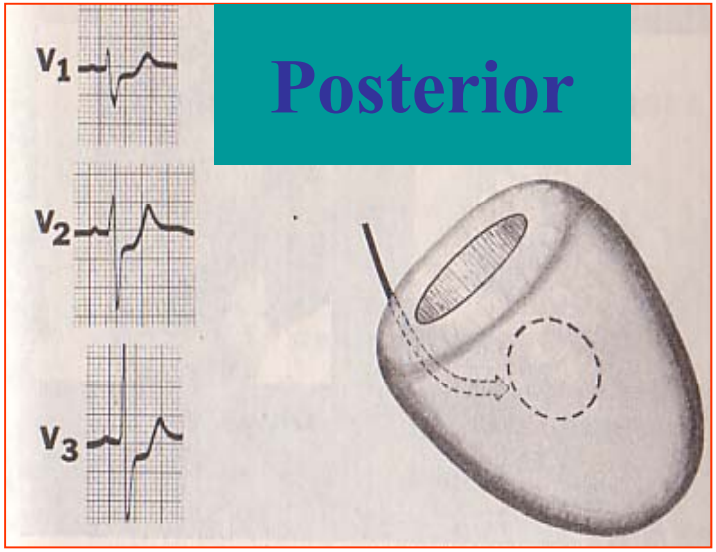
Acute Anterior MI




Anterior
V1
V2
V3
V4


Inferior
II
III
AVF


Lateral
I
AVL


Posterior
V1
V2
V3

Miscellaneous ECG Changes

1. Pulmonary Effects

- **Emphysema** = Generalized low voltage
- **Pulmonary Infarction** = $S_1Q_3T_3$

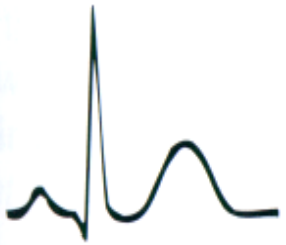
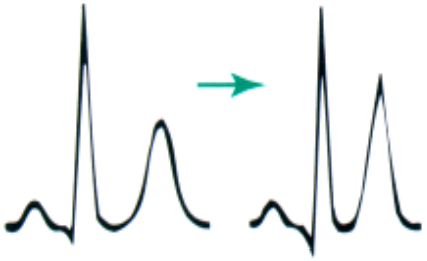
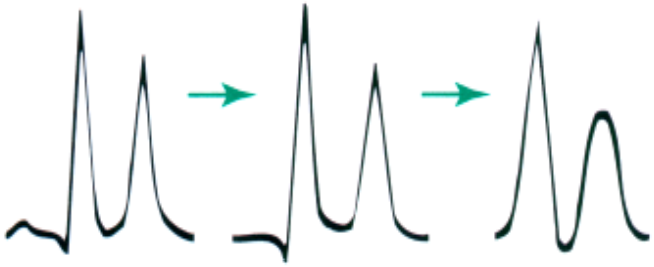
2. Electrolytes

- **K^+ , Ca^{++}**

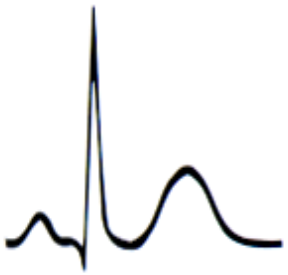
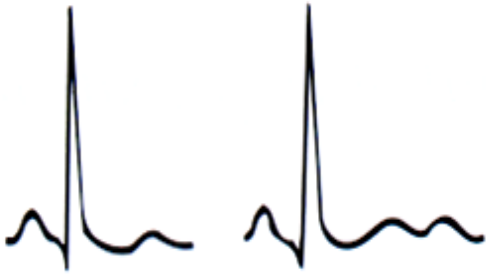
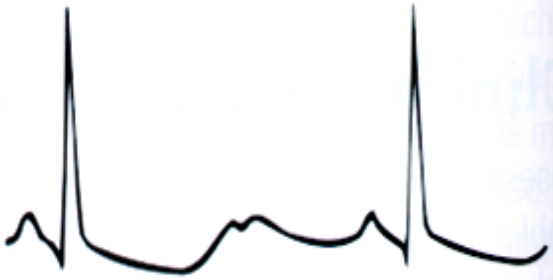
3. Pattern

- **Strain** in RVH(V_{1-2}), LVH(V_{5-6})
- **Pericarditis**,
- **Artificial Pacemaker**

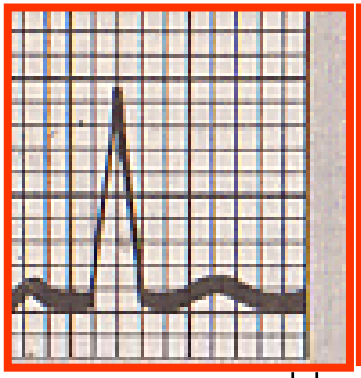
Hyperkalemia

Normal	Mild to Moderate Hyperkalemia	Marked Hyperkalemia
		
	T waves are tall and peaked with a narrow base	• P wave amplitude decreases • The QRS complex widens and ultimately becomes sinusoid

Hypokalemia

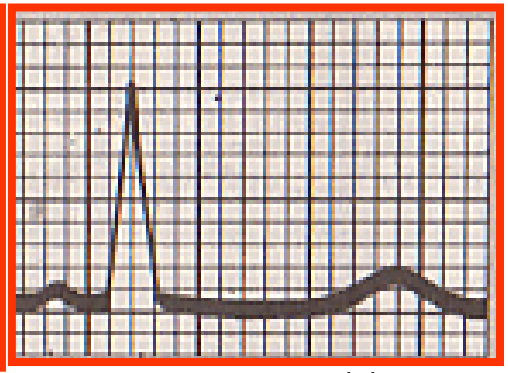
Normal	Mild to Moderate Hypokalemia	Marked Hypokalemia
		
	• T waves become flattened • ST segments may be depressed • U waves develop	• U waves increase in size • The QT (which is actually the QU) interval prolongs

Electrolytes Abnormality



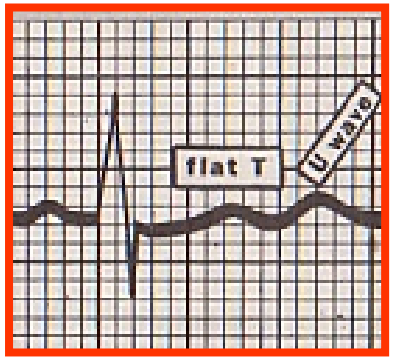
Hyper Ca^{++}

short Q-T



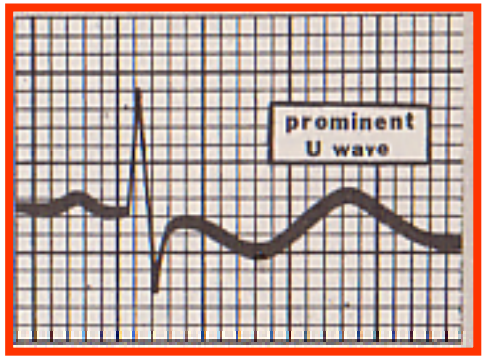
Hypo Ca^{++}

long Q-T



Hypo K^{+}

moderate

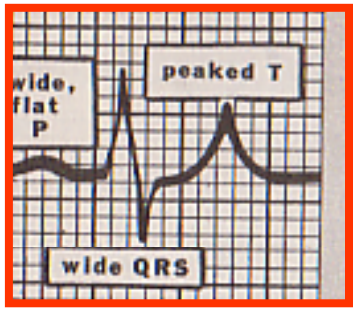


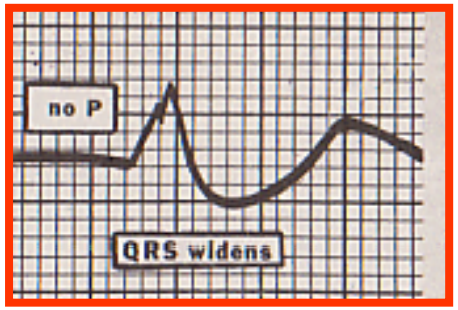
Hypo K^{+}

extreme

Hyper K^{+}

moderate





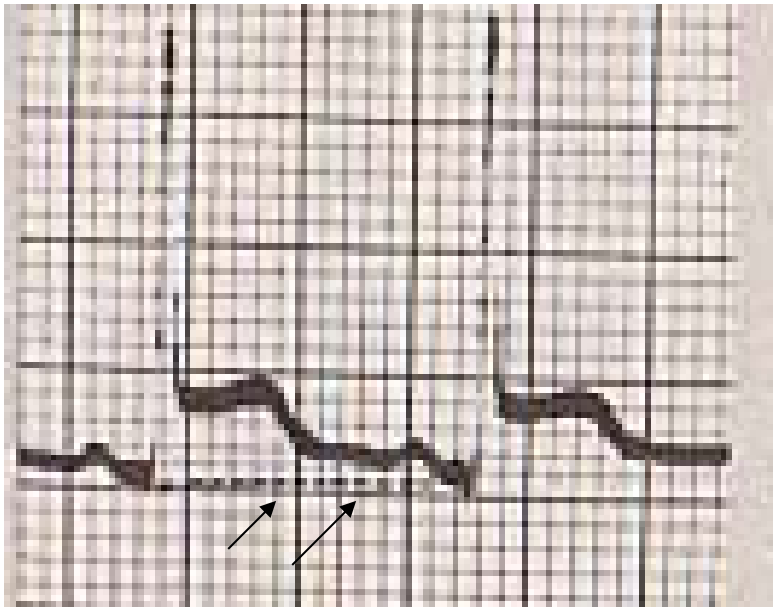
Hyper K^{+}

extreme

Pericarditis

Flat or concave ST elevation

ST elevation and T wave off baseline



Acute Pericarditis