SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT: DEPARTMENT OF CARDIAC TECHNOLOGY

SUBJECT : BASIC ECG

Unit : I

Topics : ATRIAL AND VENTRICULAR HYPERTROPHY

Atrial and Ventricular Enlargement

Cardiac Enlargement

1.Dilation
    a.stretched
    b.e.g. congestive heart failure
2.Hypertrophy
    a.increase size of heart muscle fibers
    b.e.g. aortic stenosis

Cardiac Enlargement

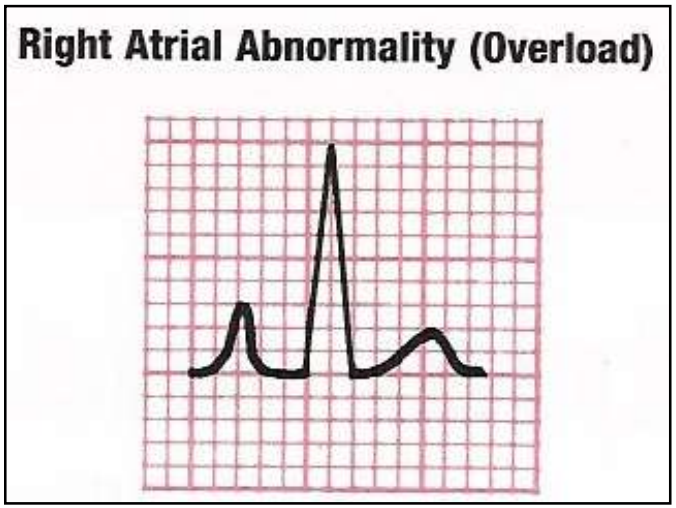
- Increase amount/area of cardiac tissue
  1. How would this affect depolarization?
  2. How could that affect an ECG?

Right Atrial Abnormality

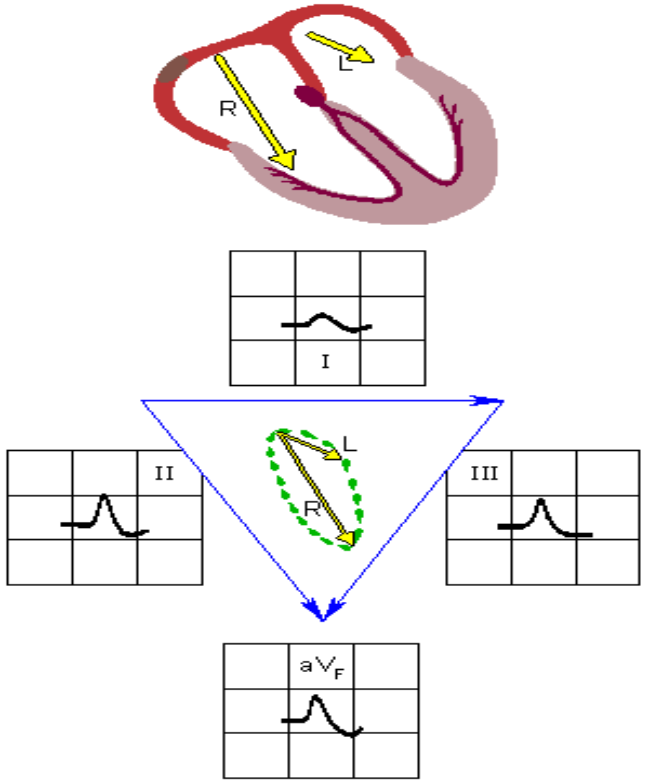
- Overload of the right atria
    1. dilation
    2. hypertrophy

also known as *P pulmonale*

- How would this change the P wave?



Right Atrial Abnormality



Right Atrial Abnormality

ECG ABNORMALITIES :

- Normal P wave is less than 2.5 mm tall and 0.12 seconds wide.

With right atrial hypertrophy, P waves are typically taller than 2.5 mm but not wider than 0.12 sec.

Right Atrial Abnormality Criteria

Tall P waves in lead II
(or III, aV_F and sometimes V_1)

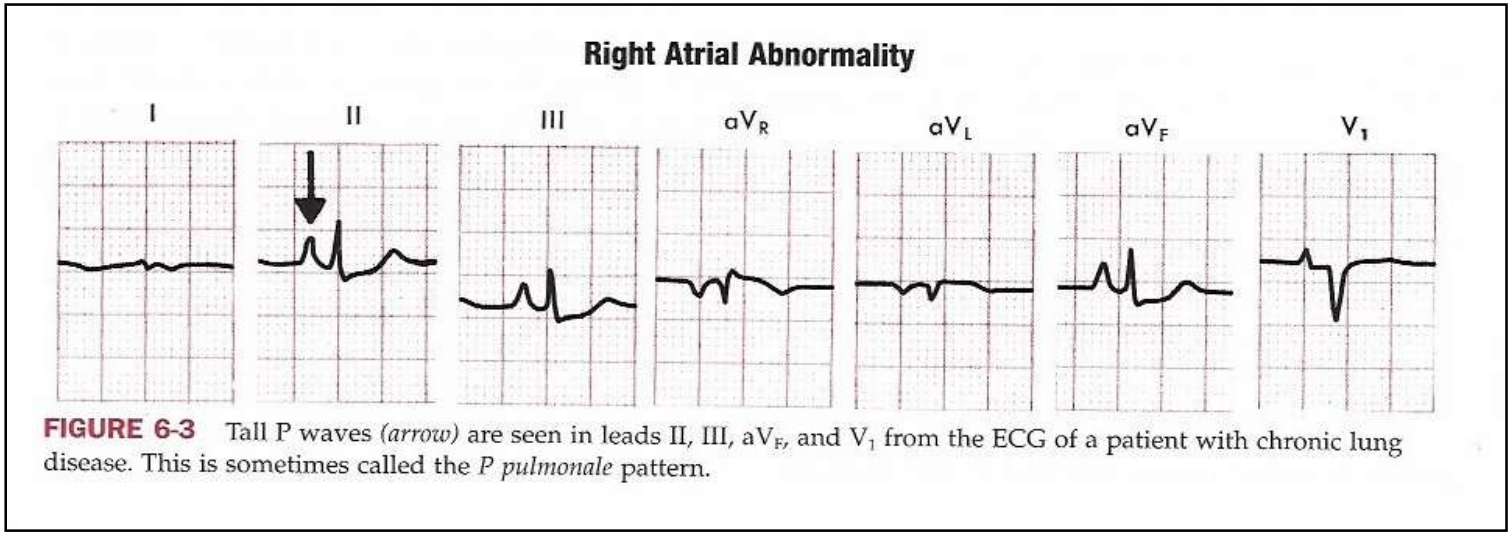


FIGURE 6-3 Tall P waves *(arrow)* are seen in leads II, III, aV_F, and V_1 from the ECG of a patient with chronic lung disease. This is sometimes called the *P pulmonale* pattern.

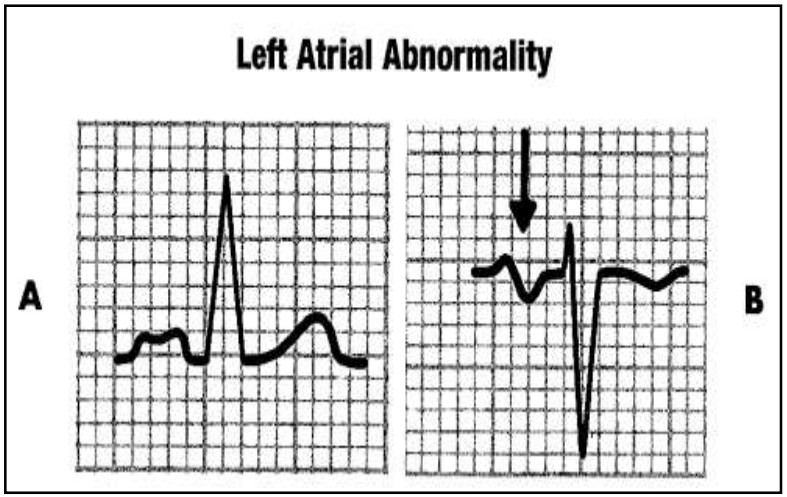
Right Atrial Abnormality

Causes:

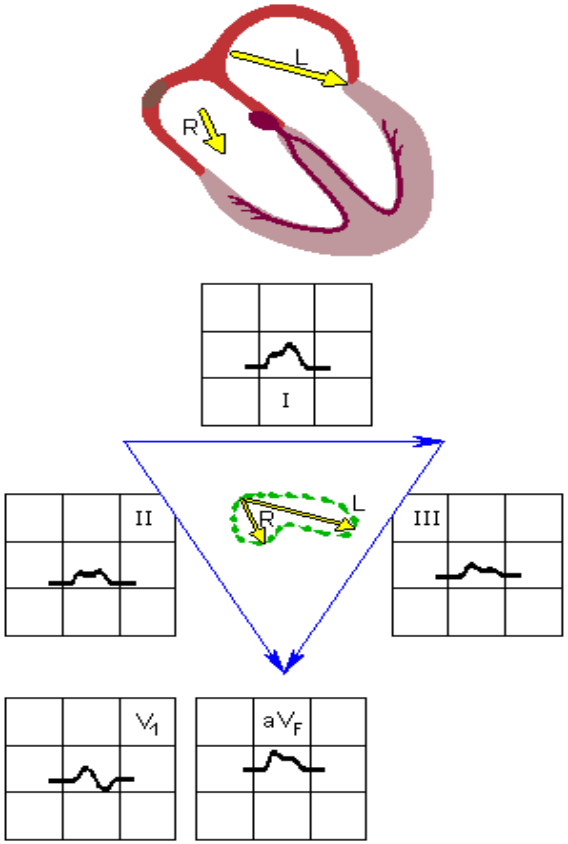
- Pulmonary disease
- Congenital heart disease

Left Atrial Abnormality

- Also known as *P mitrale*
- Left atria normally depolarizes after the right atria.
- How would this affect the P wave?
- wider; left atrial enlargement should prolong the P wave > 0.12 sec.



Left Atrial Abnormality



Left Atrial Abnormality

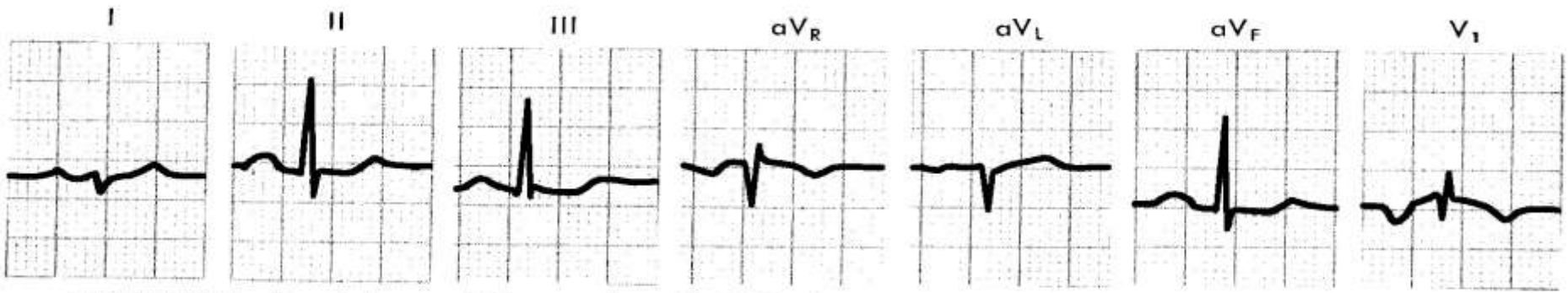


FIGURE 6-5 Broad, humped P waves from the ECG of a patient with left atrial enlargement (abnormality).

II: wide P wave

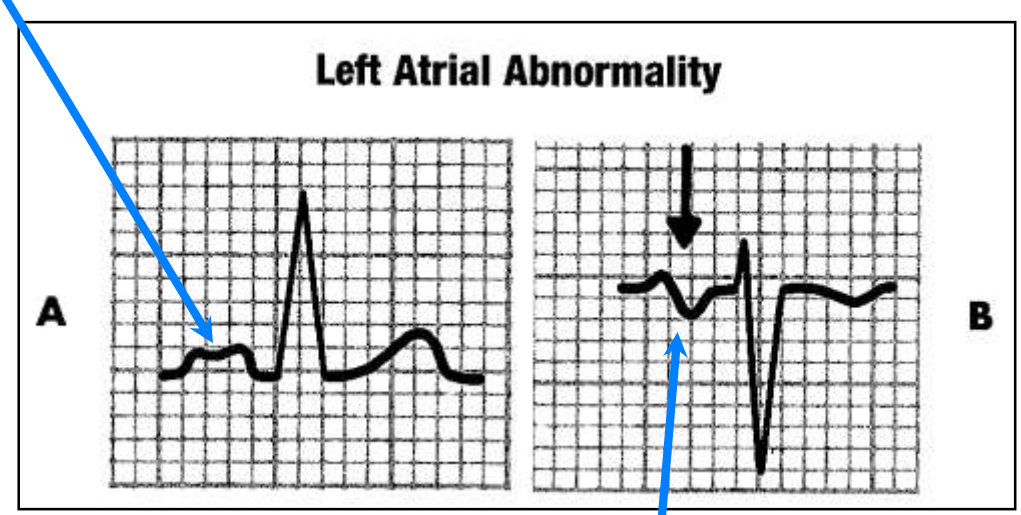
V1: negative P wave is "1 box wide, 1 box deep"

Atrial Enlargement

	Lead II	Lead V1
Right Atrial Hypertrophy		
Left Atrial Hypertrophy		

Left Atrial Abnormality

- Lead II (and I) show **wide** P waves
  - (second hump due to delayed depolarization of the left atrium)
  - (P mitrale: mitral valve disease)



Left Atrial Abnormality

- V_1 may show a **bi-phasic** P wave
  - 1 box wide, 1 box deep
  - (biphasic since right atria is anterior to the left atria)

Causes:

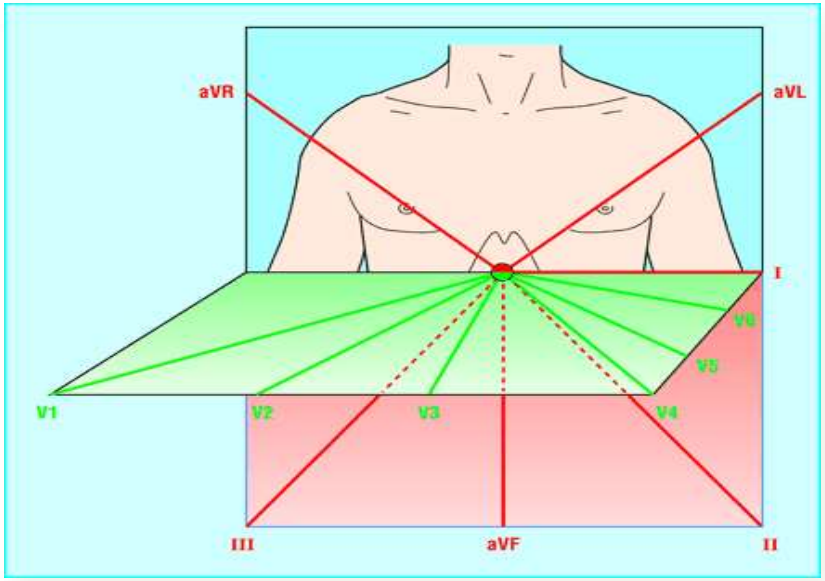
Valve disease (mitral and aortic)

Hypertensive heart disease

Cardiomyopathies

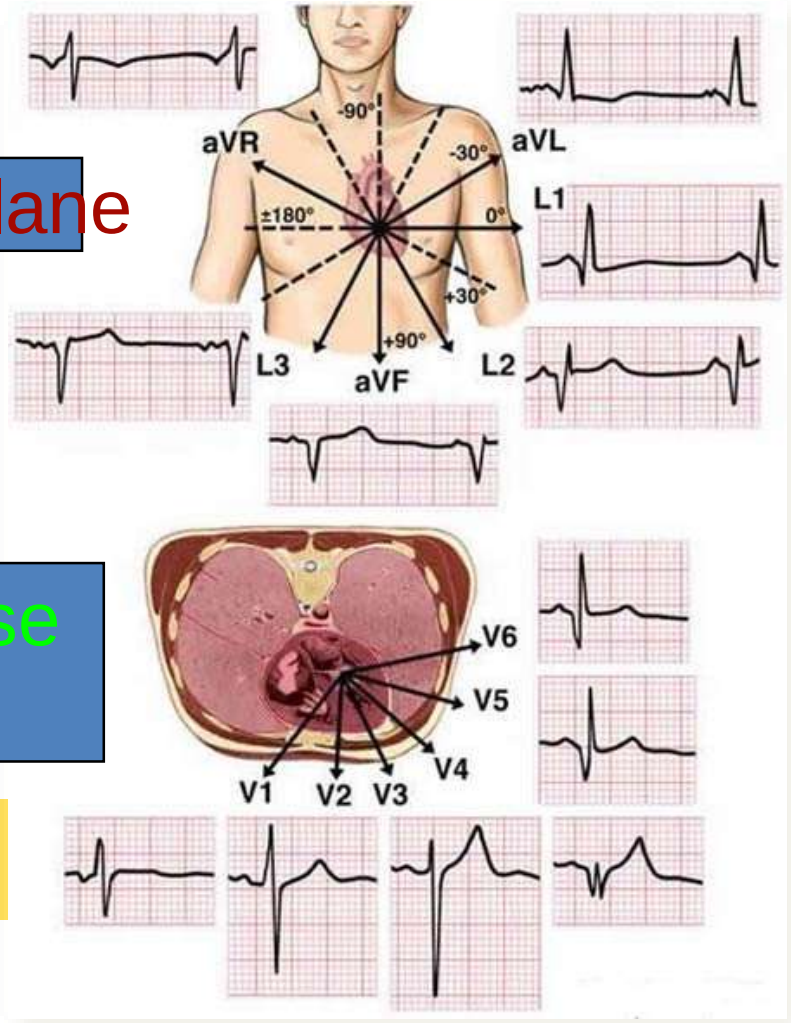
Coronary artery disease

12 Leads

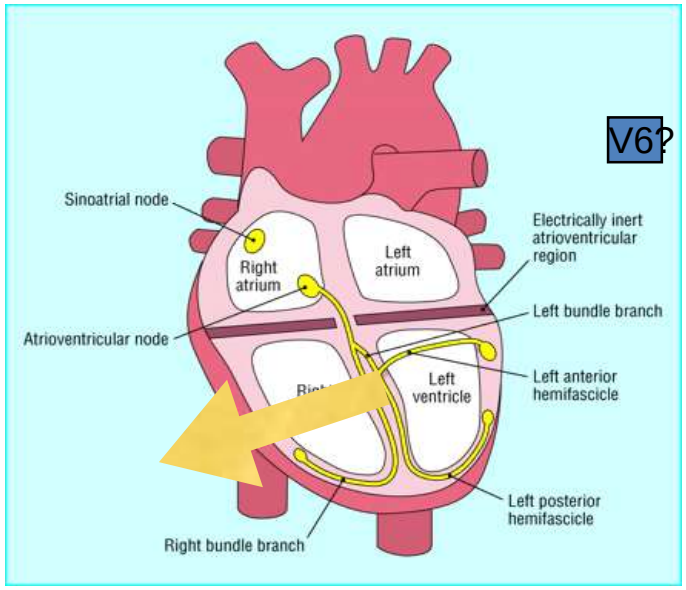


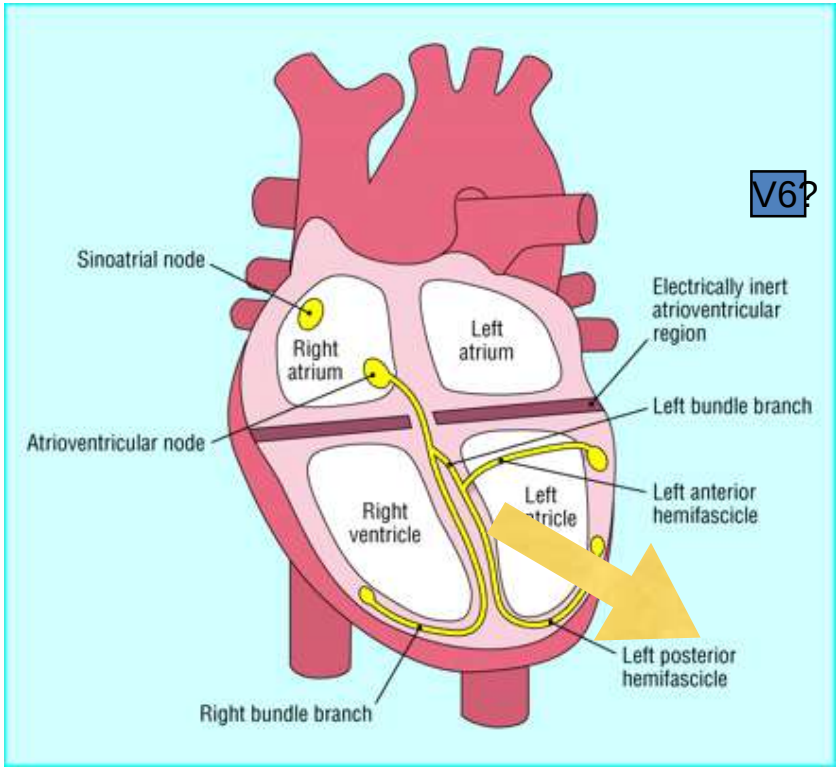
Frontal Plane

Transverse Plane



Normal QRS


V6?
Sinoatrial node
Right atrium
Left atrium
Electrically inert atrioventricular region
Left bundle branch
Atrioventricular node
Left ventricle
Left anterior hemifascicle
Left posterior hemifascicle
Right bundle branch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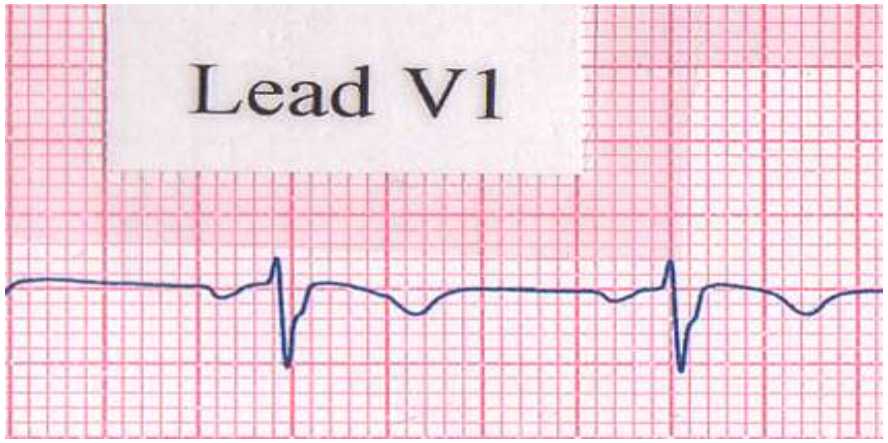
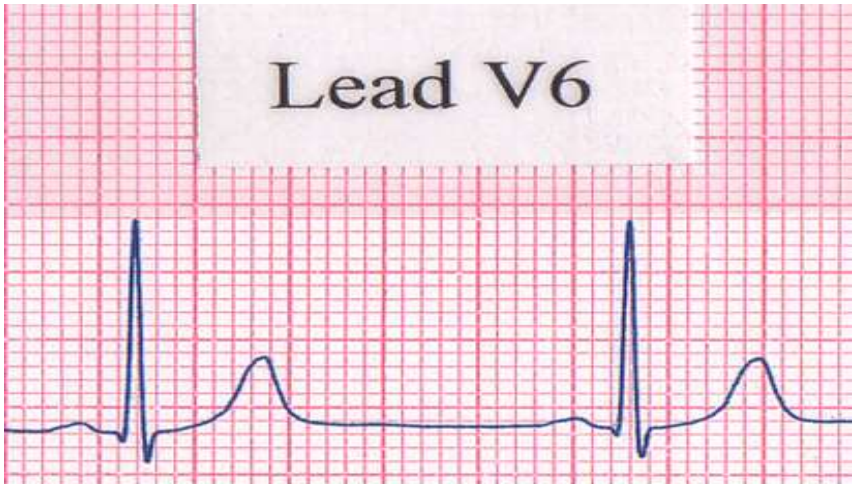
Normal QRS





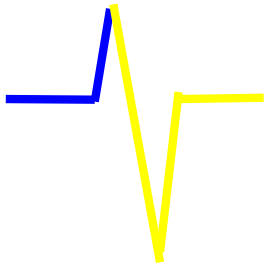
Right Ventricular Hypertrophy

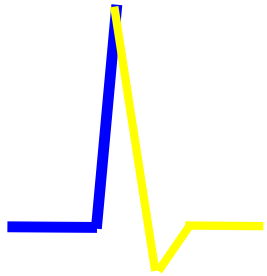
What do you think will happen to the ECG with ventricular hypertrophy?

Right Ventricular Hypertrophy

Consider right ventricular hypertrophy and V_1
How would V_1 be different?

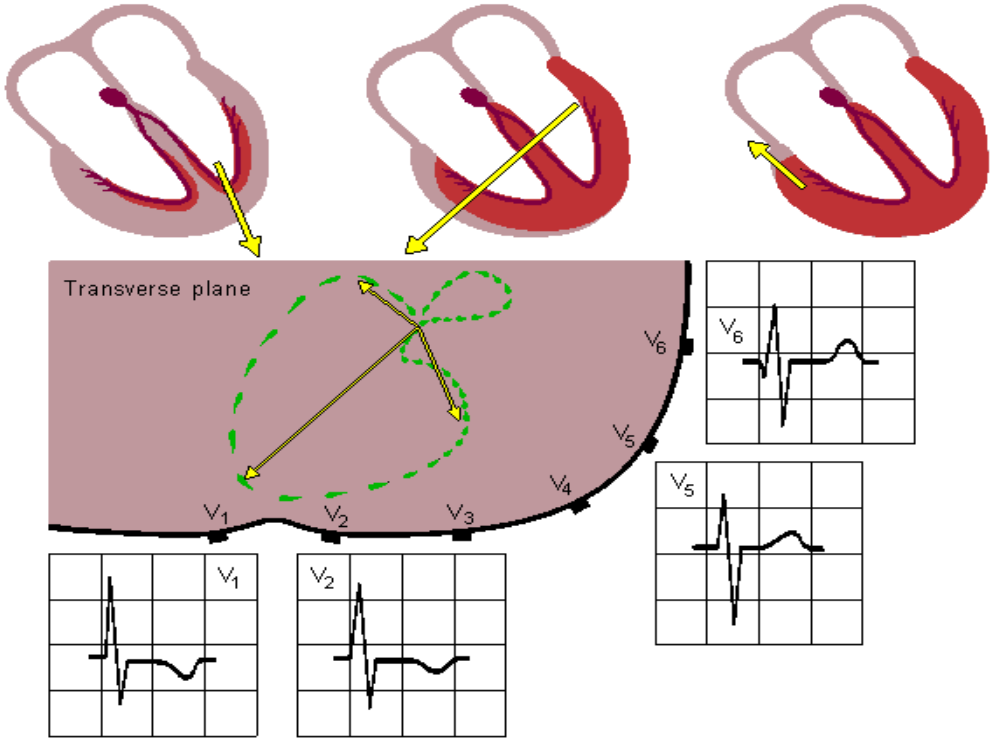
Normal





Hypertrophy

Right Ventricular Hypertrophy



Right Ventricular Hypertrophy
Criteria

1.In V_1, R wave is greater than the S wave - or - R in V1 greater than 7 mm

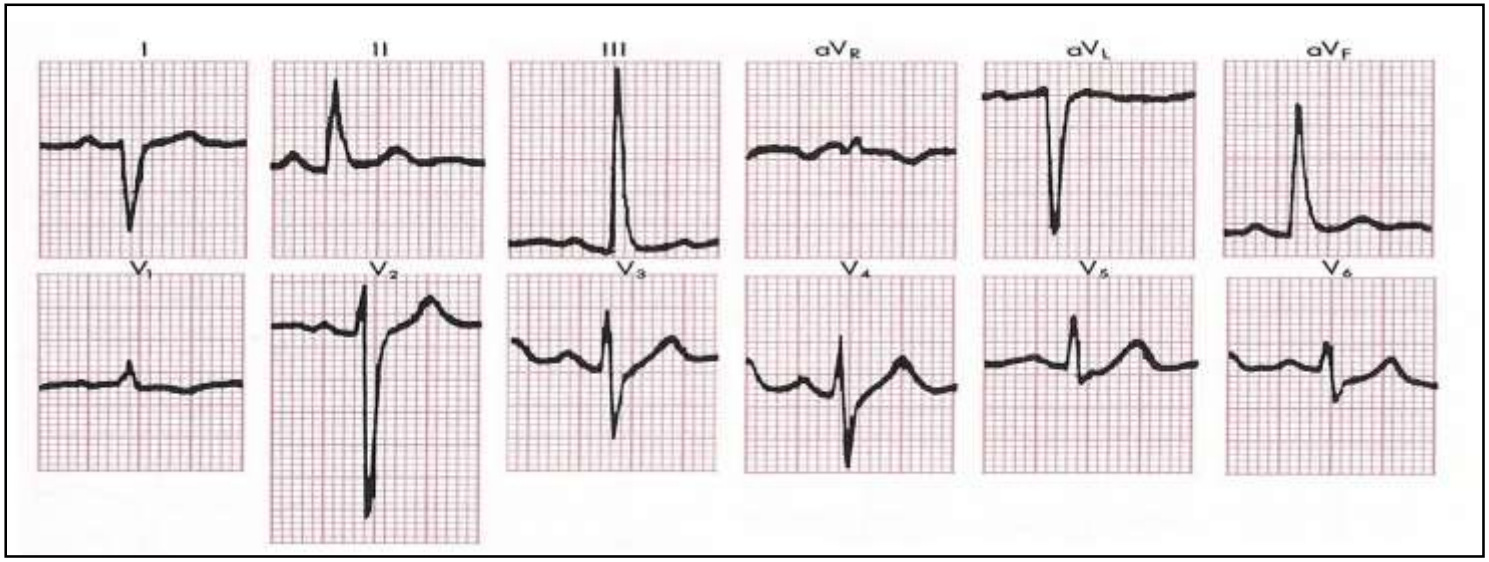
1. Right axis deviation
2. In V_1, T wave inversion (reason unknown)
3. S waves in V5 and V6

Right Ventricular Hypertrophy

- **Causes of RVH**
  - pulmonary disease
  - congenital heart disease

(Emphysema may mask signs of RVH)

- Posterior wall MI may also show tall R waves in V1



R wave and T wave in V1?

What about the axis?

ECG Interpretation*

1. Rate
    1. RR interval
    2. Heart rate

2. Rhythm
    1. PP interval
    2. P wave
        1. width, height, shape, etc.
3. PR interval

4.QRS

1.width (and height)

2.axis

3.R wave progression

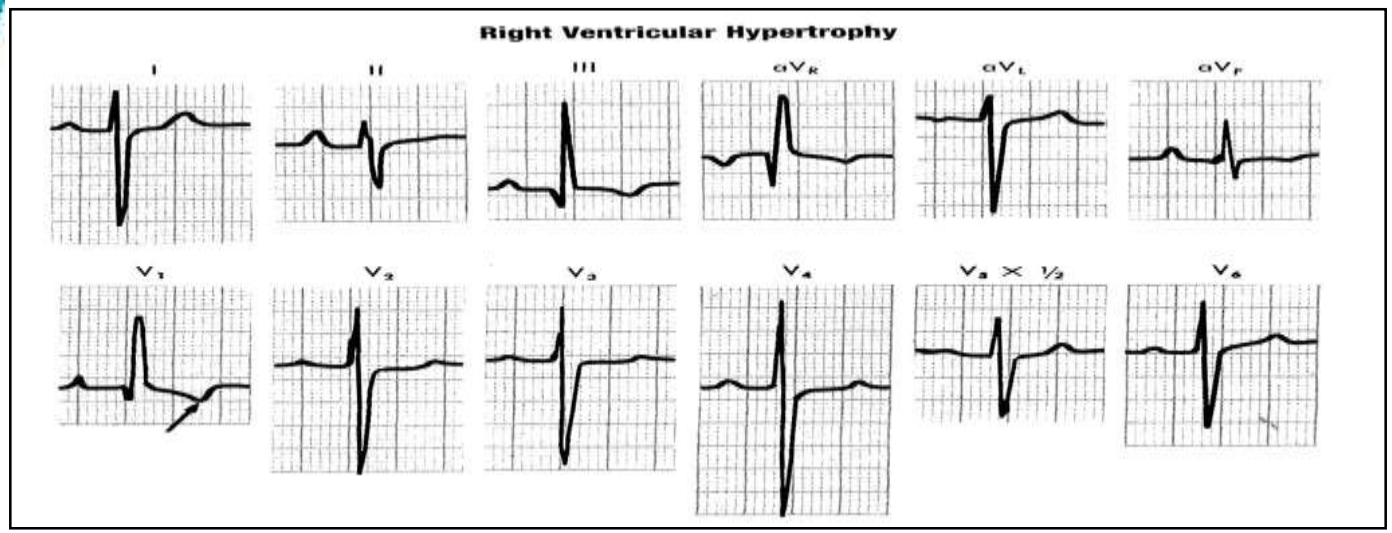
4.abnormal Q waves

5.QT interval

6.ST segment

7.T waves

8.U waves



R wave in V1.
P waves in II, III, & V1

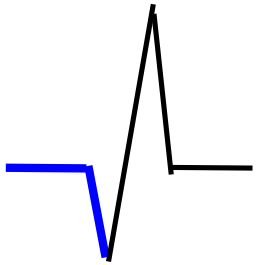
T wave inversion
PR interval

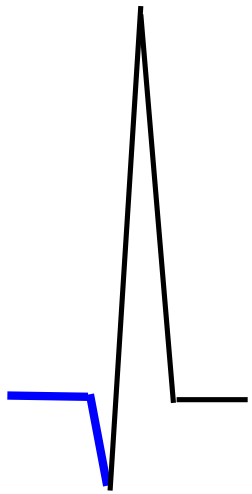
Left Ventricular Hypertrophy

- With LVH, the electrical balance is tipped even further to the left.

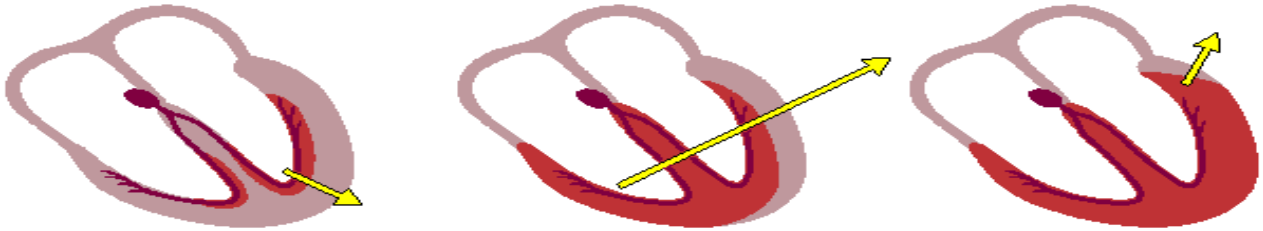
- Tall R waves in the left chest leads

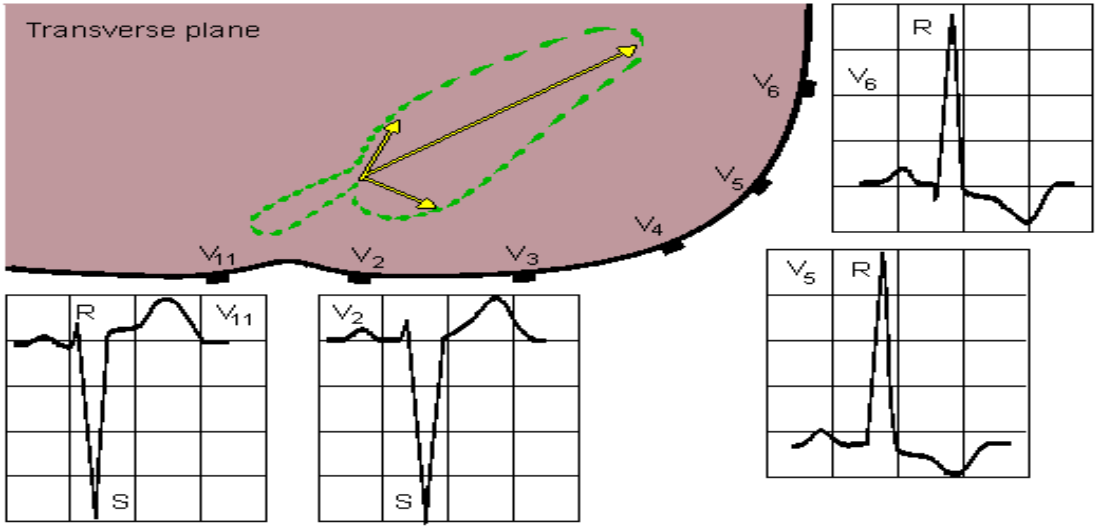
Predominate S waves in the right chest leads





Left Ventricular Hypertrophy





Left Ventricular Hypertrophy Criteria

- Sokolow-Lyon Voltage Criteria
  - If S wave in V_1 + R wave in V_5 or V_6 **≥ 35 mm** (**≥ 50** for under 35 yrs of age)
  - R wave > 11 mm in aV_L or I...
- Also
  - LVH is more likely with a "strain pattern" or ST segment changes
  - Left axis deviation
  - Left atrial abnormality

Left Ventricular Hypertrophy

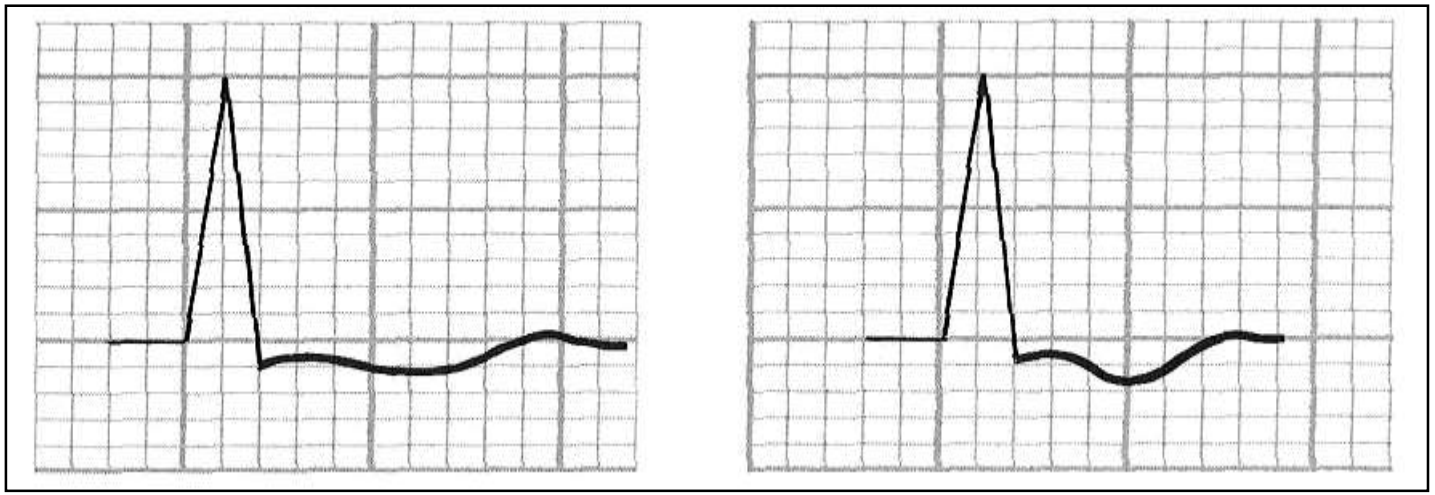
- Causes:
  1. Hypertension
  2. Aortic stenosis
  3. not always pathological
- Risks of LVH
  1. congestive heart failure
  2. arrhythmias

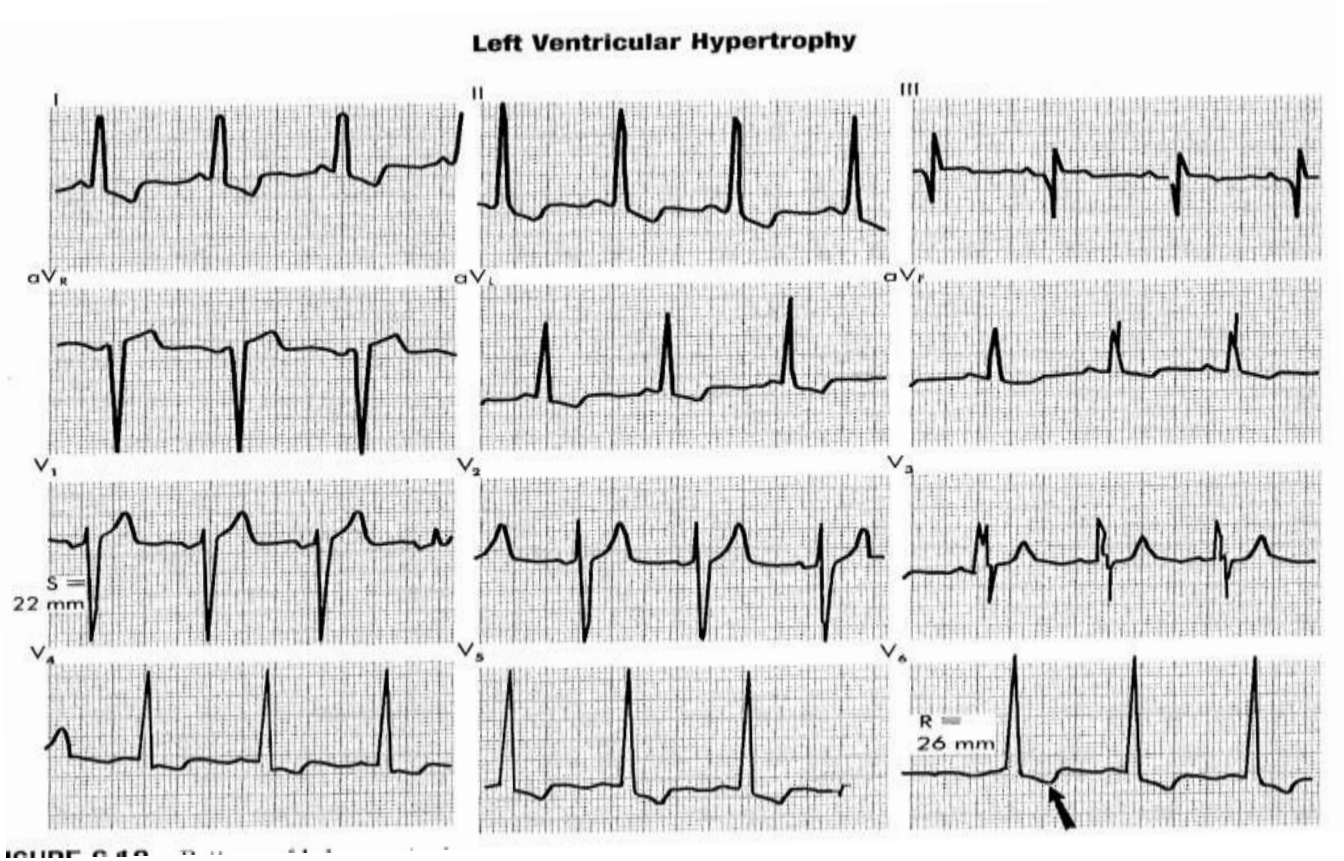
Left Ventricular Hypertrophy

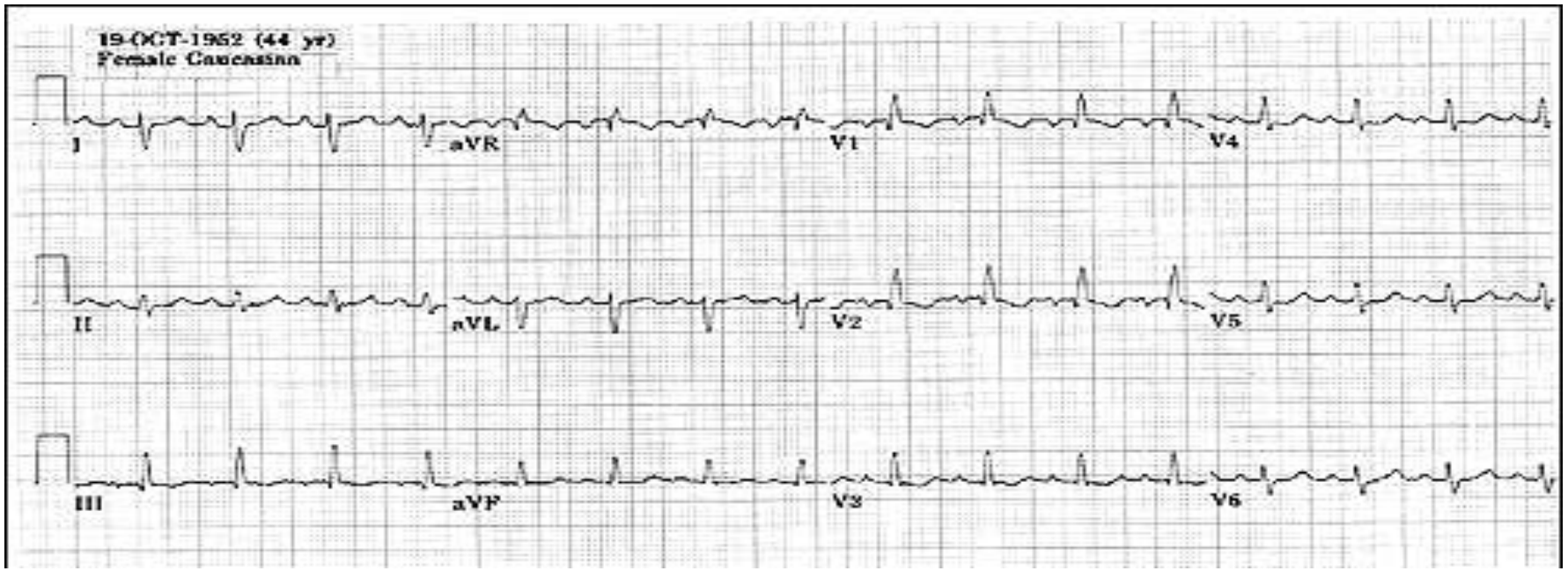
- High voltage can be seen in normal people, especially athletes

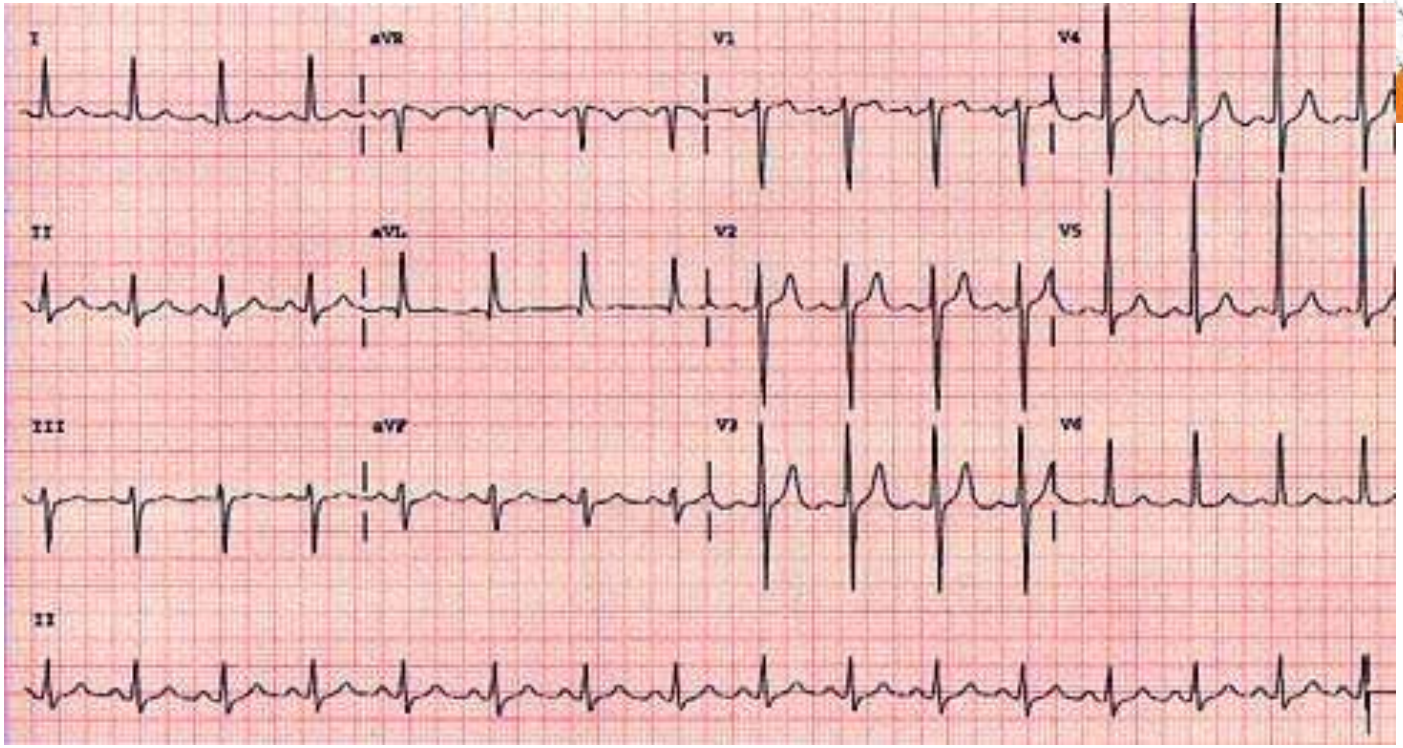
With hypertrophy in both ventricles, the ECG will show more evidence of LVH

ST strain patterns

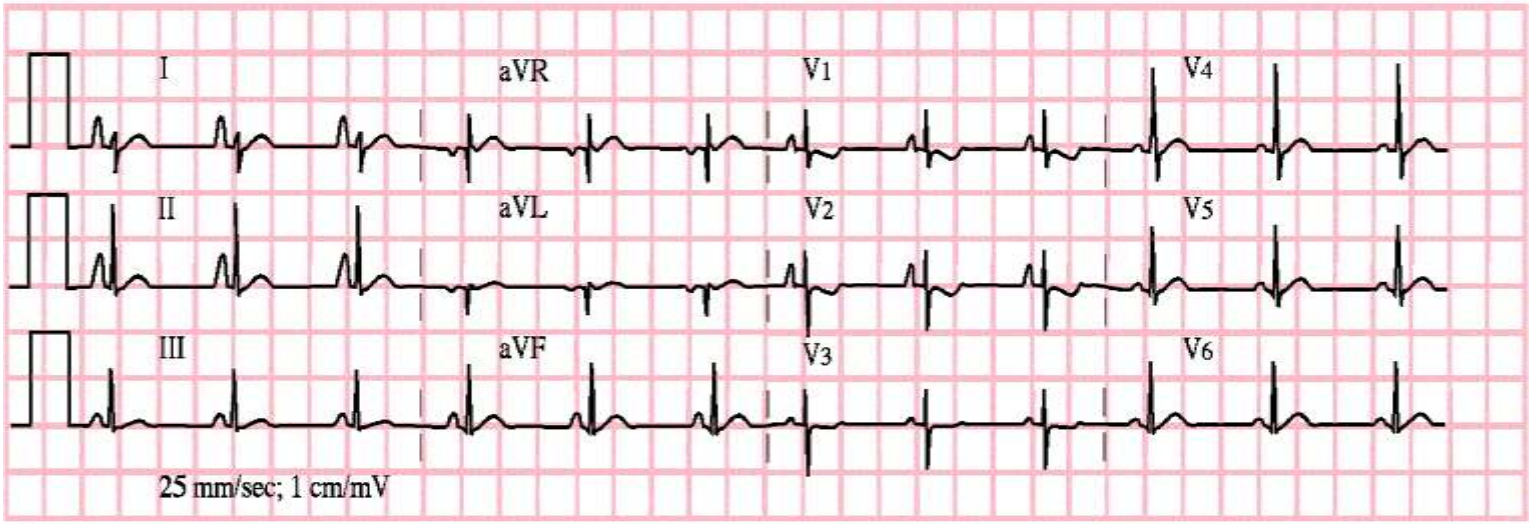



Left Ventricular Hypertrophy
I
II
III
aVR
aVL
aVF
V1
V2
V3
S =
22 mm
V4
V5
V6
R =
26 mm

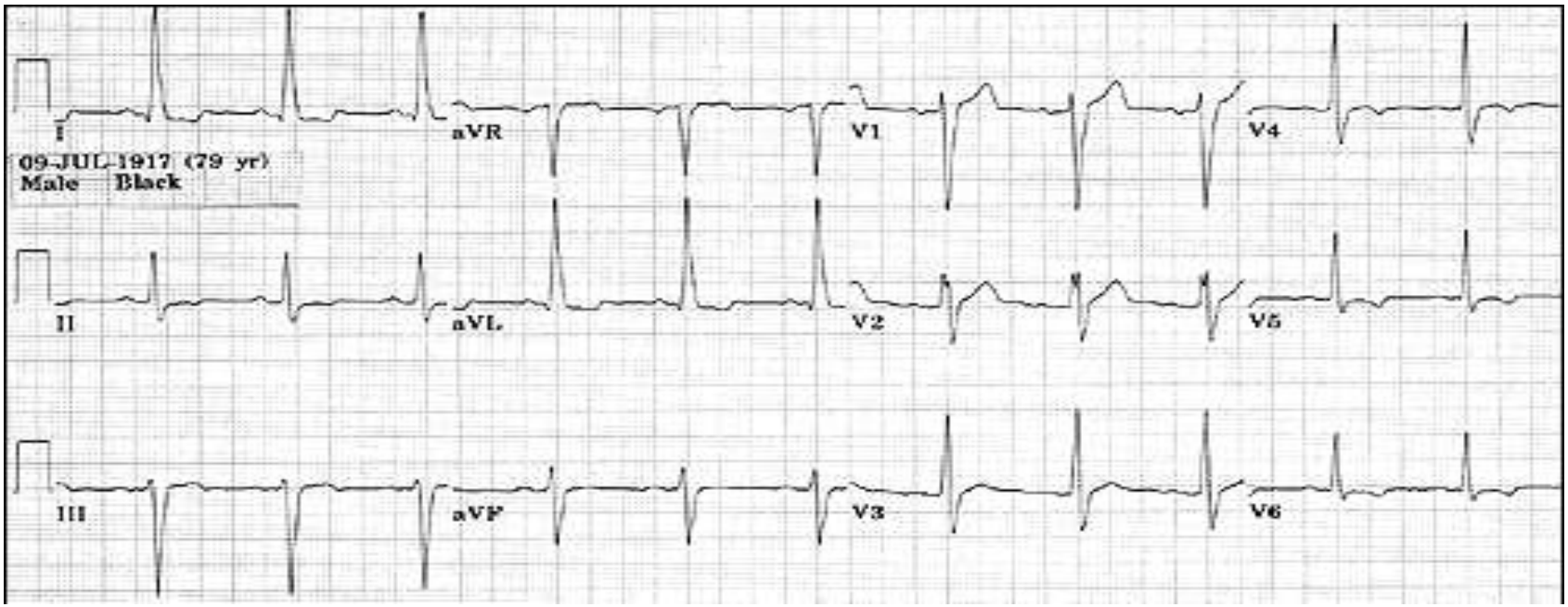

19-OCT-1952 (44 yr)
Female Caucasian
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

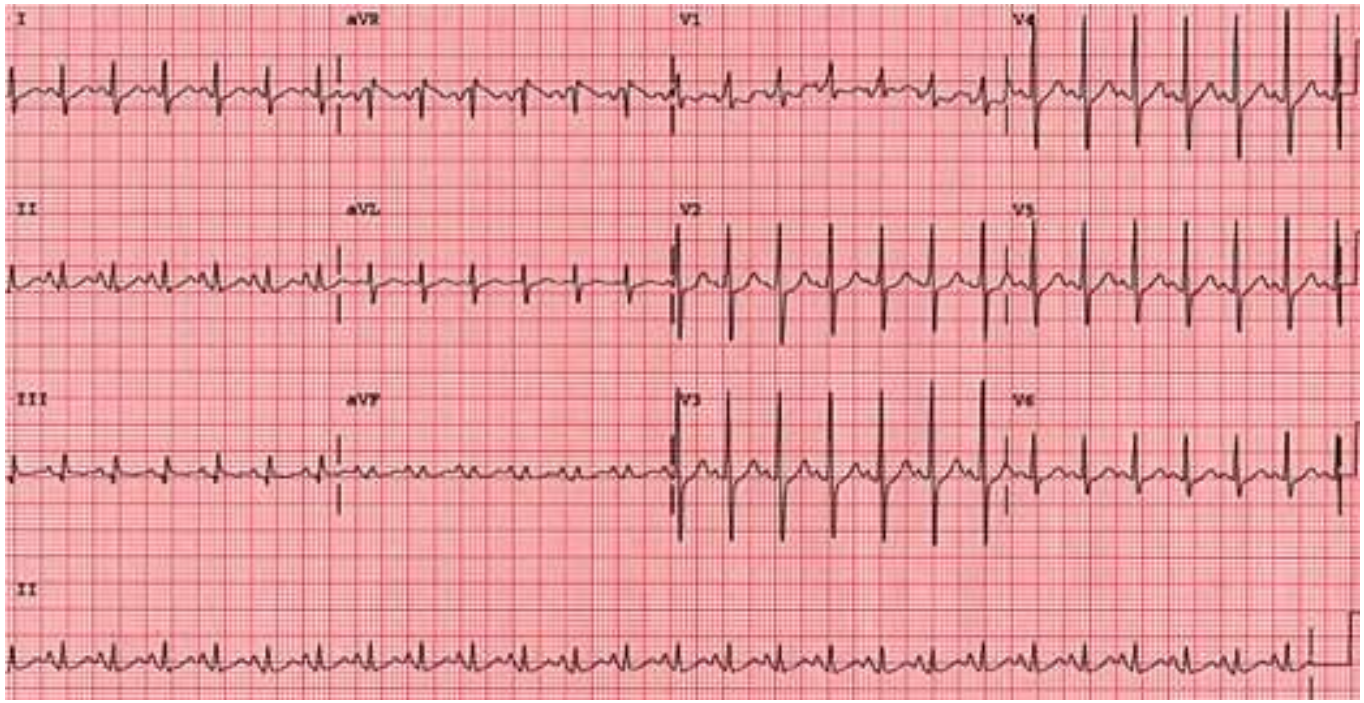


Left ventricular hypertrophy (S wave V2 plus R wave of V5 greater than 35mm) and left atrial enlargement (II and V1).

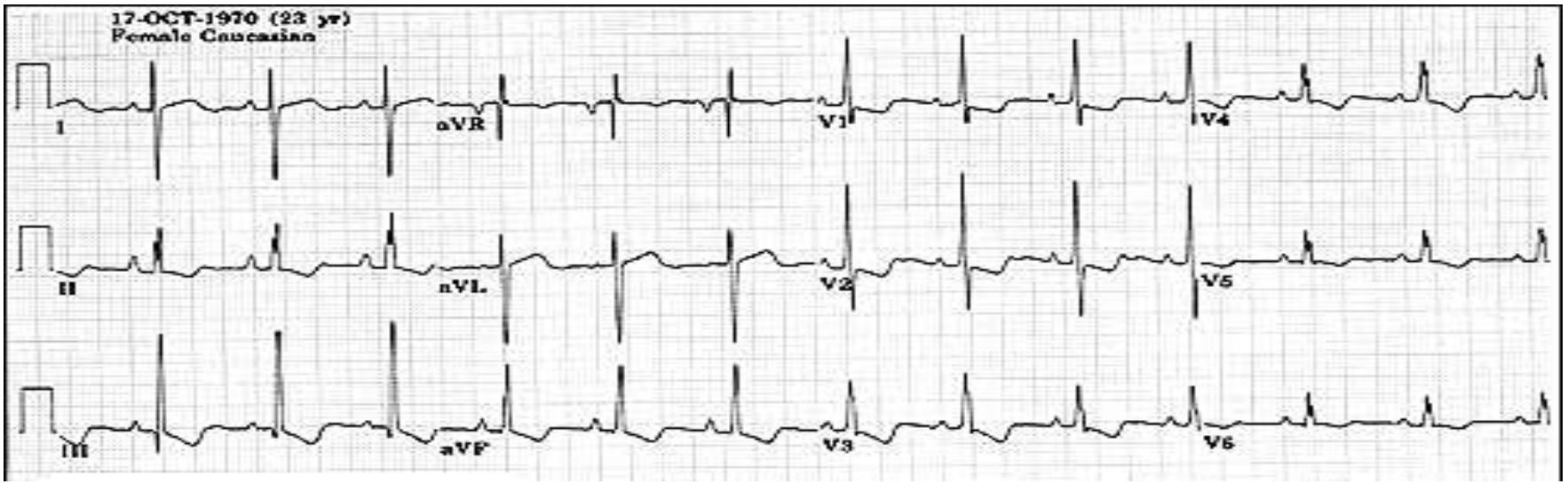


Right atrial enlargement

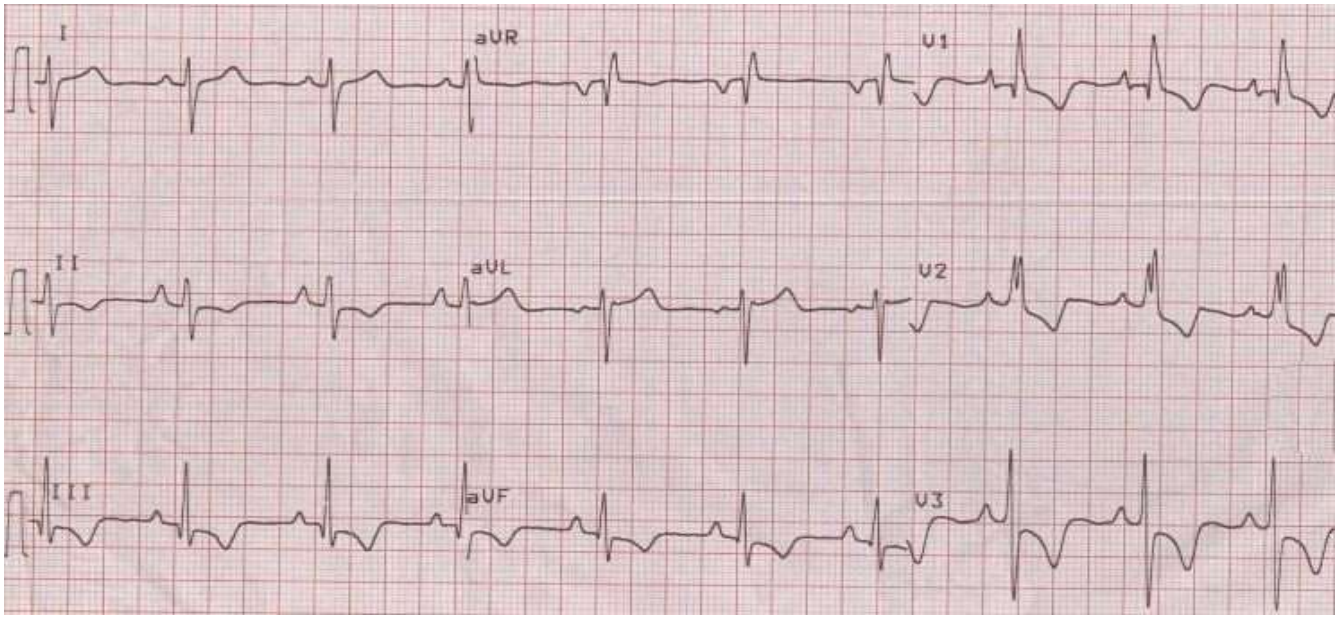

I
aVR
V1
V4
09-JUL-1917 (79 yr)
Male Black
II
aVL
V2
V5
III
aVF
V3
V6



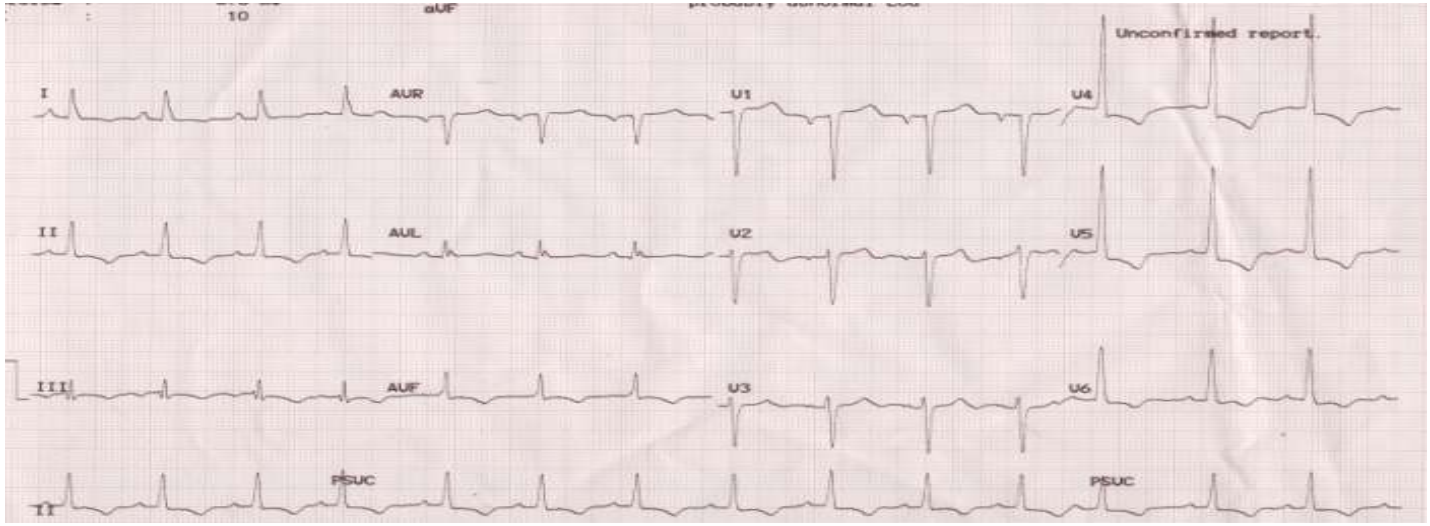
Right ventricular hypertrophy and right atrial enlargement.


17-OCT-1970 (23 yr)
Female Caucasian
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6

RVH



Right axis deviation (predominant negative QRS in leads I and aVl) of QRS complex and qR pattern in V1 suggests severe **right ventricular hypertrophy**. Sharp P waves in inferior leads and V1 indicate right atrial overload. T wave inersion in inferior and anterior leads are secondary to right ventricular hypertrophy.



Tall R waves in V4 and V5 with down sloping ST segment depression and T wave inversion are suggestive of **left ventricular hypertrophy** (LVH) with strain pattern. LVH with strain pattern usually occurs in pressure overload of the left ventricle as in systemic hypertension or aortic stenosis. Similar pattern may also occur in long standing severe aortic regurgitation, though the usual pattern in aortic regurgitation is left ventricular volume overload.

ASSESSMENT

1. Mention The ECG changes for RVH ?
2. Deference Between LA and RA obnormalities ?