

## EMC 451 Advanced ECG Interpretation

### Hypertrophy

EMC 451 Hypertrophy

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## Unit Objectives

Upon completion of this unit, the student will be able to:

- Describe the causes and ECG changes associated with right atrial enlargement (RAE)
- Describe the causes and ECG changes associated with left atrial enlargement (LAE)
- Describe the causes and ECG changes associated with right ventricular hypertrophy (RVH)
- Describe the causes and ECG changes associated with left ventricular hypertrophy (LVH)

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## Cardiac Enlargement

- Dilation
  - Heart muscle is stretched and chamber becomes enlarged.
  - Example: CHF caused by acute aortic regurgitation dilates the left ventricle
- Hypertrophy
  - Heart muscle fibers increase in size, with resultant enlargement of the chamber.
  - Example: aortic stenosis obstructs the outflow of blood from the left ventricle, leading to left ventricular hypertrophy.

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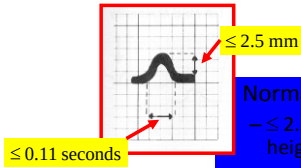
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## Atrial Enlargement



### Normal P wave

- $\leq 2.5$  mm ( $2\frac{1}{2}$  small boxes) in height (or depth)
- $< 0.11$  seconds (less than 3 small boxes) in width

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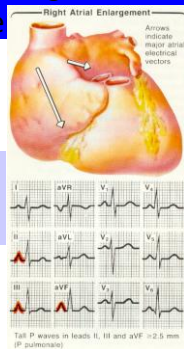
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## EKG Changes of Right Atrial Enlarge

- P waves  $\geq 2.5$  mm in leads II, III, and aVF



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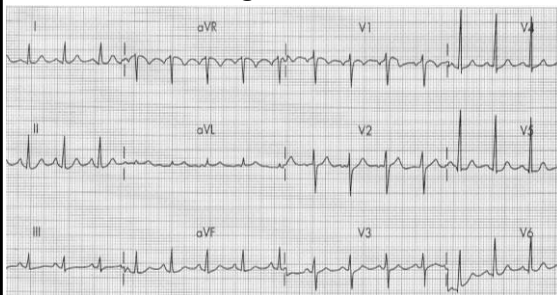
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## EKG Changes of Right Atrial Enlargement continued



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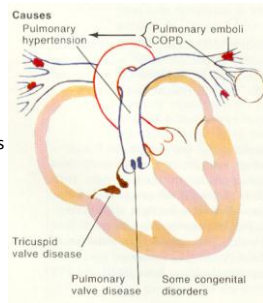
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## Causes of Right Atrial Enlargement

- Pulmonary Hypertension
- Pulmonary embolus
- COPD
- Tricuspid valve disease
- Pulmonary valve disease



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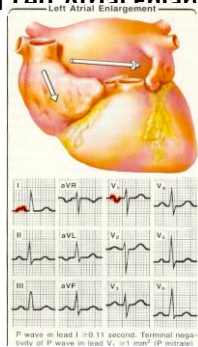
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## EKG Changes of Left Atrial Enlargement

- P wave in lead I  $\geq 0.11$  seconds
- Terminal negativity of P wave in Lead  $V_1$



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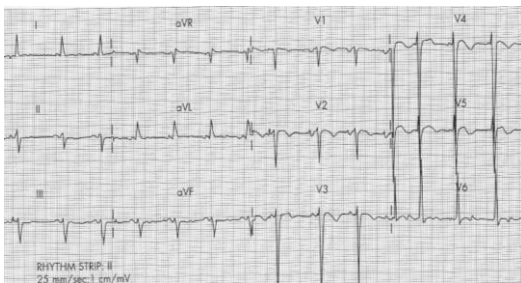
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## EKG Changes of Left Atrial Enlargement continued



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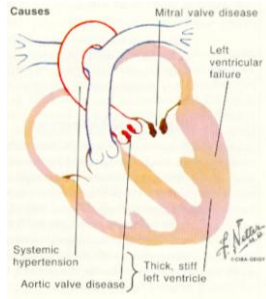
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## Causes of Left Atrial Enlargement

- Systemic hypertension
- Mitral valve disease
- Left ventricular failure
- Aortic valve disease
- Thickened left ventricle



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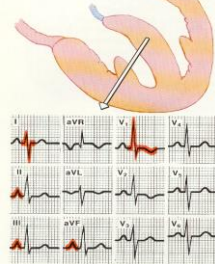
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## EKG Changes of Right Ventricular

H<sub>1</sub> — Right Ventricular Hypertrophy

Arrows indicate major electrical vectors of ventricular depolarization



- R wave > S wave in V<sub>1</sub>
- RAD
- Right ventricular strain pattern (inverted T waves in V<sub>1</sub>-V<sub>3</sub>)

Tall R wave in lead V<sub>1</sub> (=S wave in V<sub>1</sub>). T wave inverted in V<sub>1</sub>. Right axis deviation. Associated right atrial enlargement

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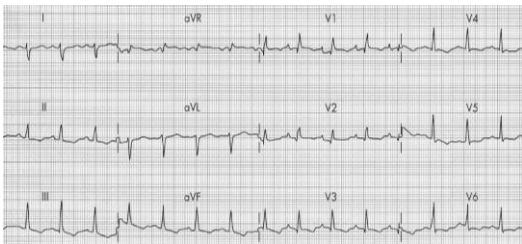
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## EKG Changes of Right Ventricular Hypertrophy



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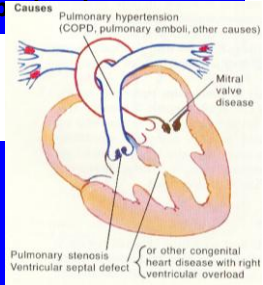
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## Causes of Right Ventricular Hypertrophy

- Pulmonary hypertension
- COPD
- Pulmonary embolus
- Mitral valve disease
- Pulmonary stenosis
- VSD



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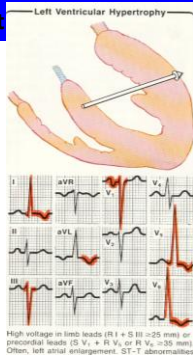
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## EKG Changes of Left Ventricular Hypertrophy

- R in lead I + S in lead III  $\geq 25$  mm

Or

- S in  $V_1$  + tallest R of  $V_5$  and  $V_6 \geq 35$  mm



High voltage in limb leads ( $R I + S III \geq 25$  mm) or prefrontal leads ( $S V_1 + R V_5$  or  $R V_6 \geq 35$  mm). Often, left atrial enlargement, ST-T abnormalities

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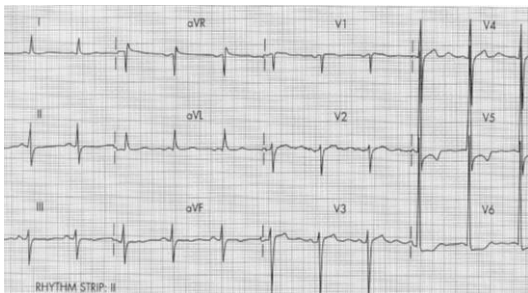
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## EKG Changes of Left Ventricular Hypertrophy continued



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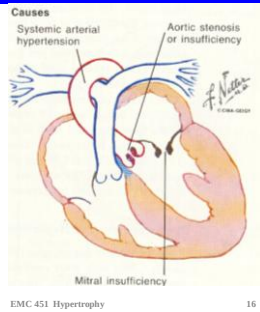
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## Causes of Left Ventricular Hypertrophy

- Systemic hypertension
- Mitral regurgitation
- Aortic stenosis
- Aortic regurgitation



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