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Hypertrophy, Bundle Branch Block and Preexcitation

Fast & Easy ECGs – A Self-Paced Learning Program



Hypertrophy

- Condition in which muscular wall of the ventricle(s) becomes thicker than normal

Dilation or Enlargement

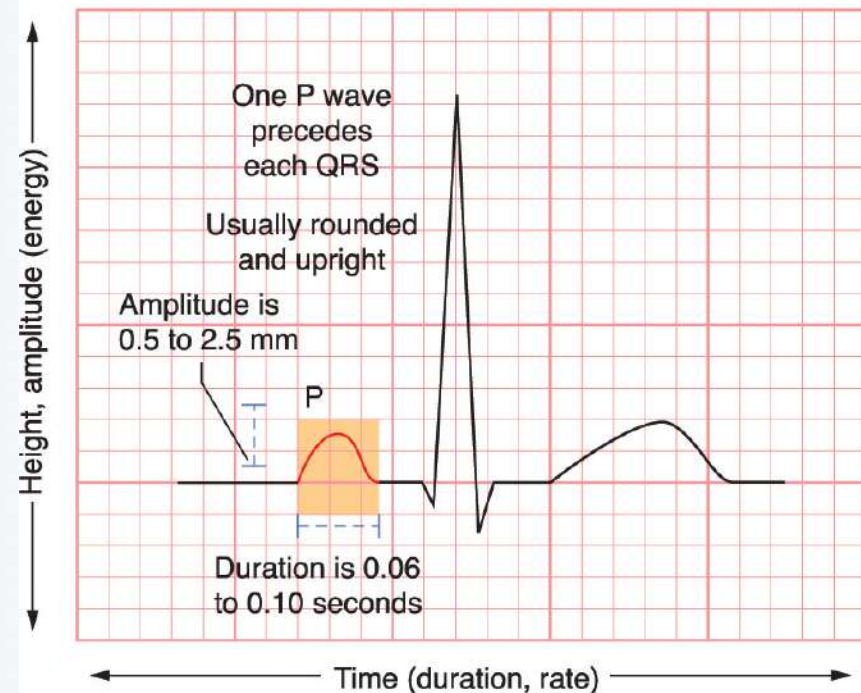
- Occurs as result of volume overload where chamber dilates to accommodate increased blood volume

Hypertrophy or Enlargement

- Enlargement associated with atria
 - P wave changes used to identify atrial enlargement
- Hypertrophy associated with ventricles
 - QRS complex changes used to identify ventricular hypertrophy

Normal P Wave

- Duration 0.06 – 0.10 seconds
- Amplitude 0.5 – 2.5 mm
- First portion represents right atrial depolarization
- Terminal portion represents left atrial depolarization

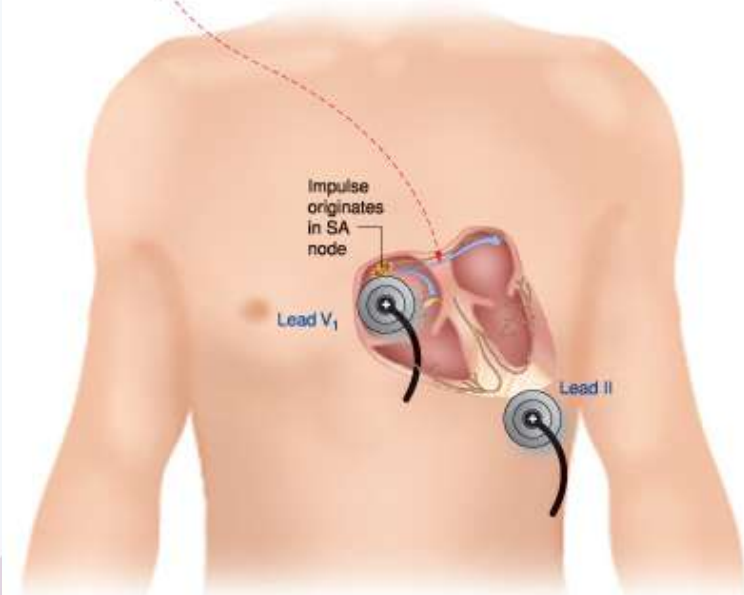


Atrial Enlargement

- Caused by various conditions
 - Chronic pulmonary disease may cause right atria enlargement in response to the need for greater filling pressures in the right ventricle
 - Mitral valve prolapse may result in blood being forced backwards into the left atria causing it to enlarge

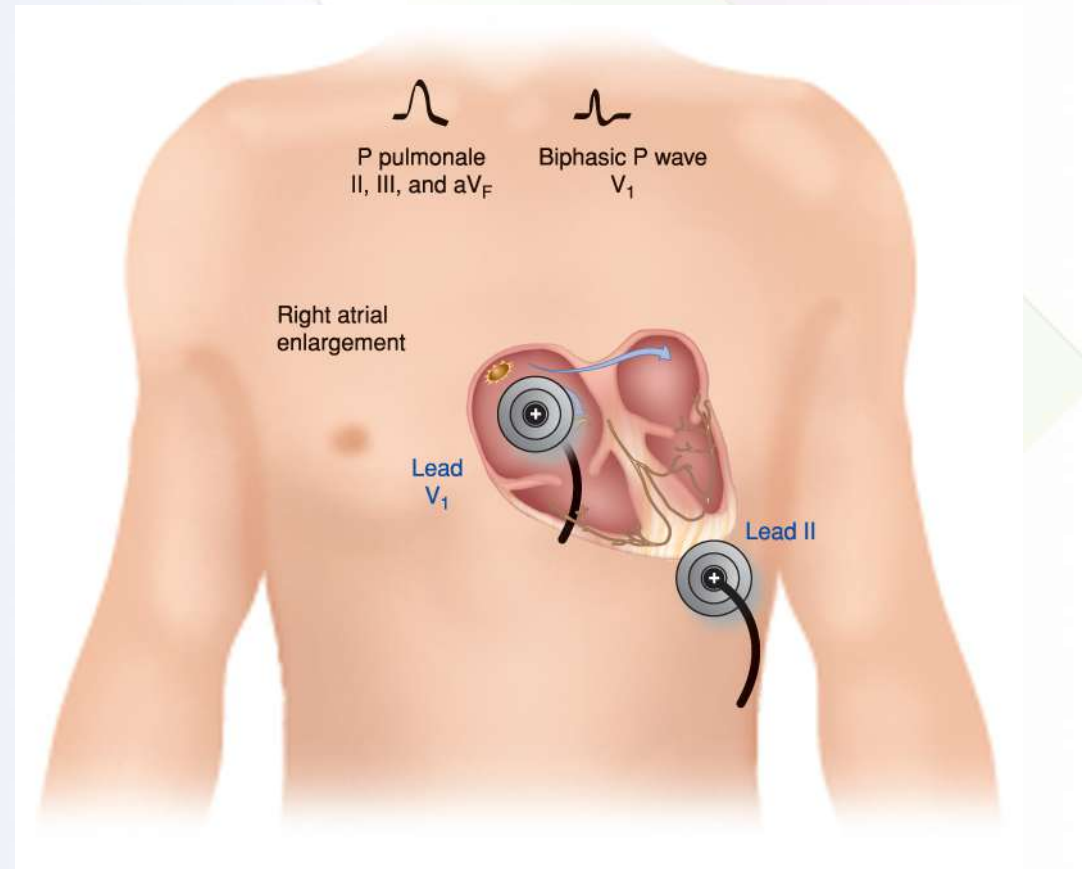
Atrial Enlargement

- Leads II and V₁ used to assess atrial enlargement



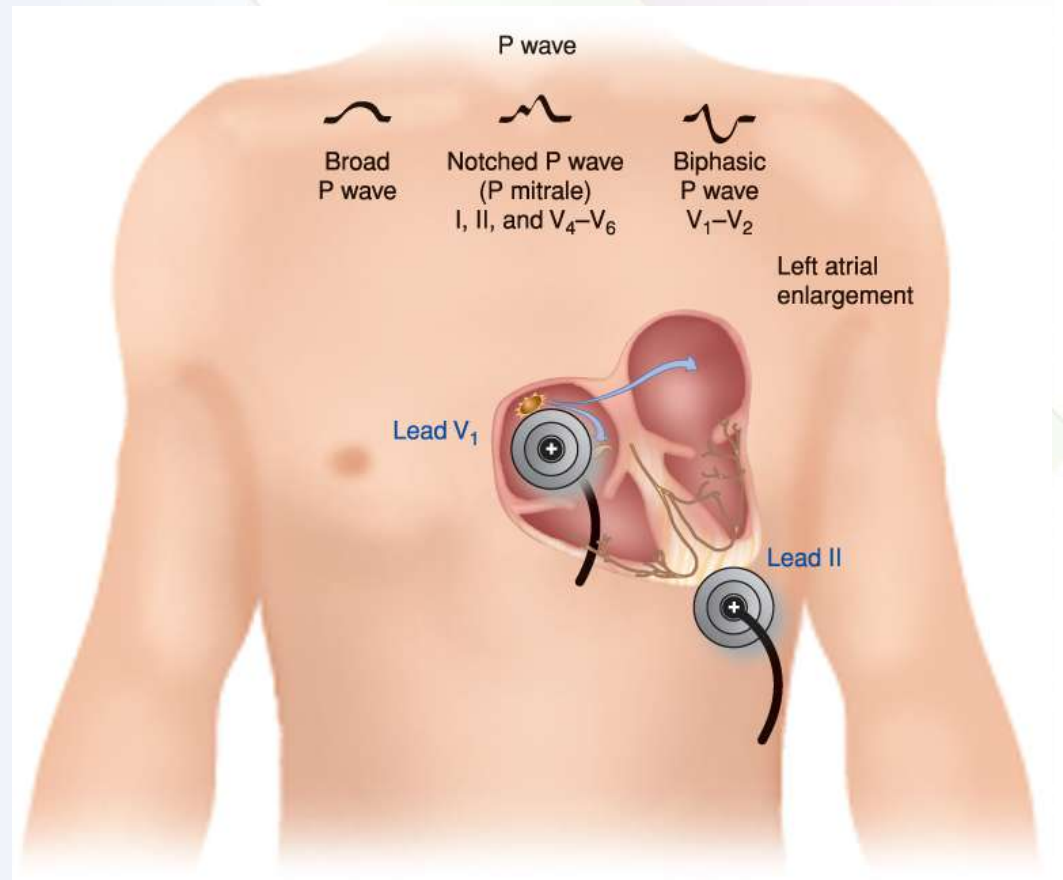
Right Atrial Enlargement

- Increase in amplitude of the first part of the P wave



Left Atrial Enlargement

- Increased amplitude in the terminal portion of the P wave in V_1
- Increased duration or width of the P wave

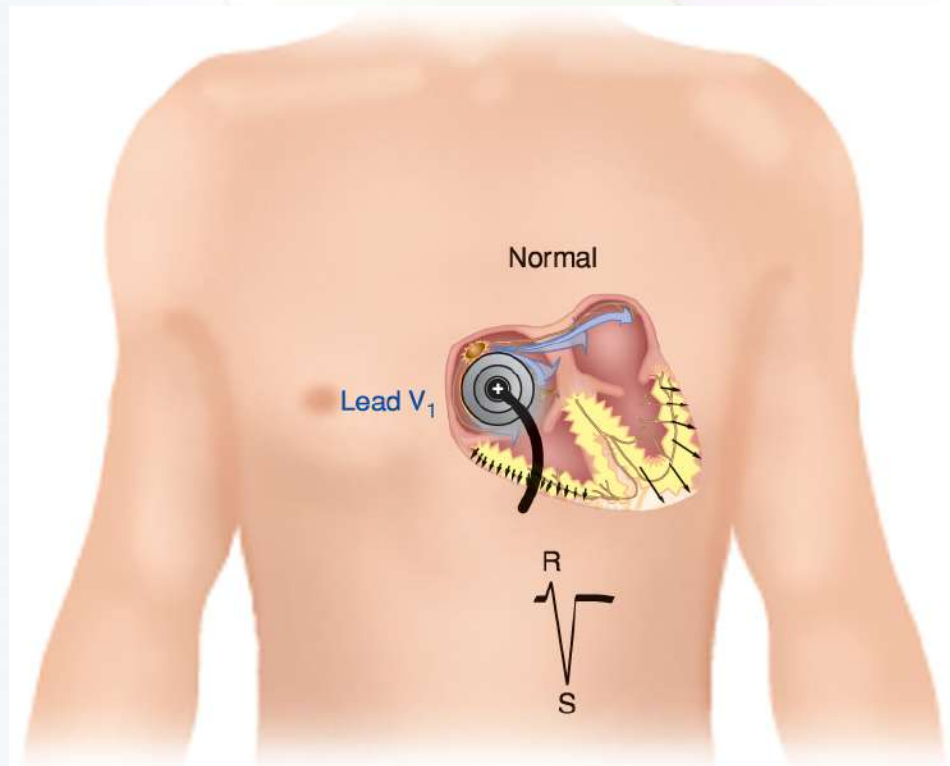


Ventricular Hypertrophy

- Commonly caused by chronic, poorly treated hypertension
- Because there is more muscle to depolarize there is more electrical activity occurring in the hypertrophied muscle
 - Reflected by changes in the amplitude of portions of the QRS complex

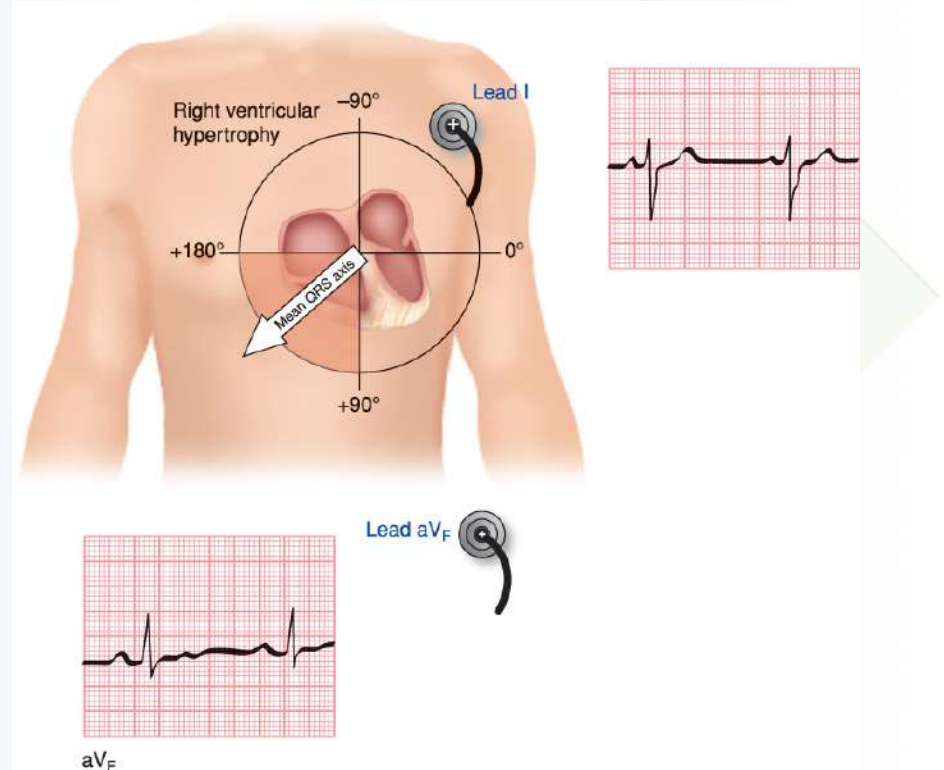
Ventricular Hypertrophy

- V_1 electrode normally positive
- Wave of depolarization moving through LV moving away from electrode
- Produces mainly negative QRS complexes (short R waves with larger S waves)



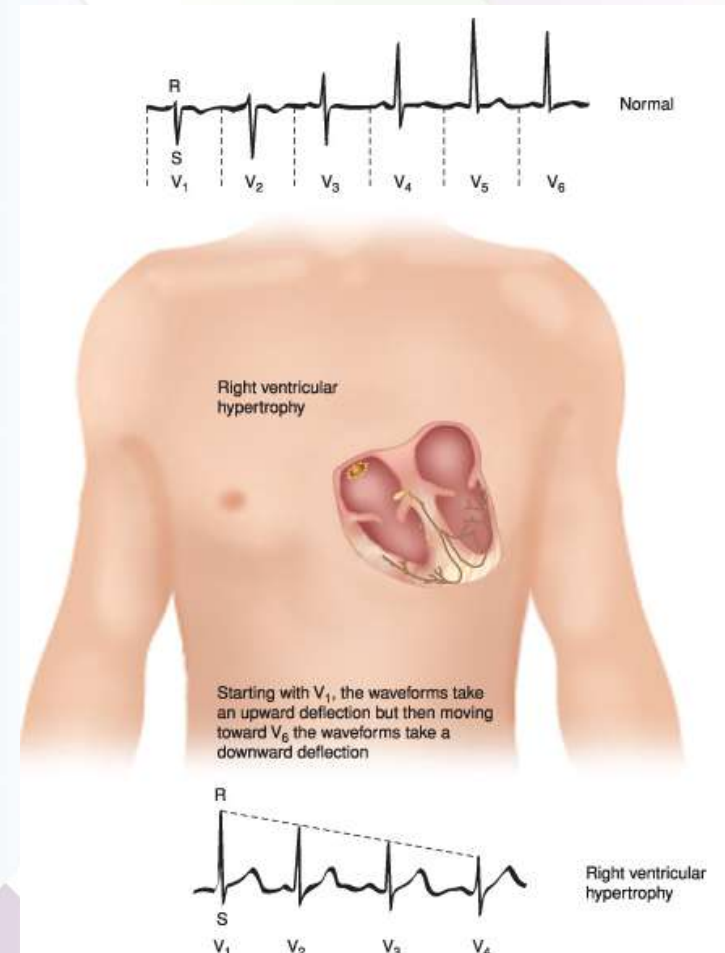
Right Ventricular Hypertrophy

- Most common characteristic in limb leads is right axis deviation



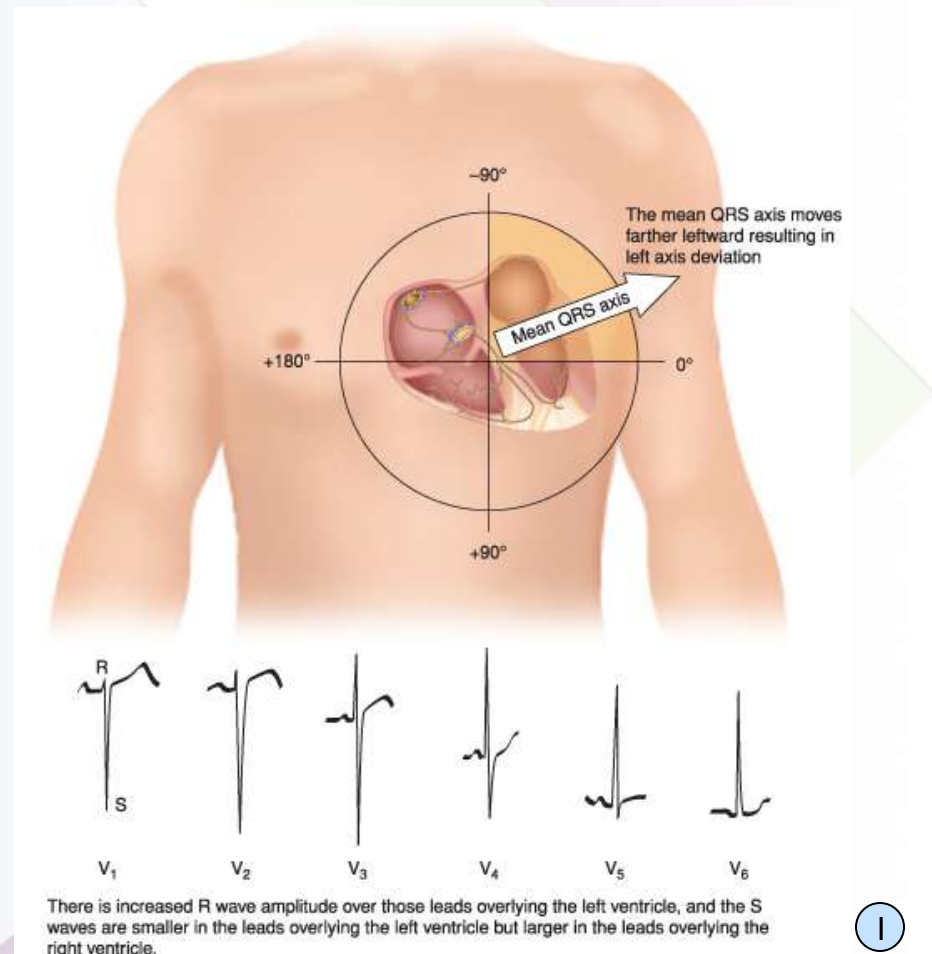
Right Ventricular Hypertrophy

- In precordial leads R waves are more positive in leads which lie closer to lead V_1



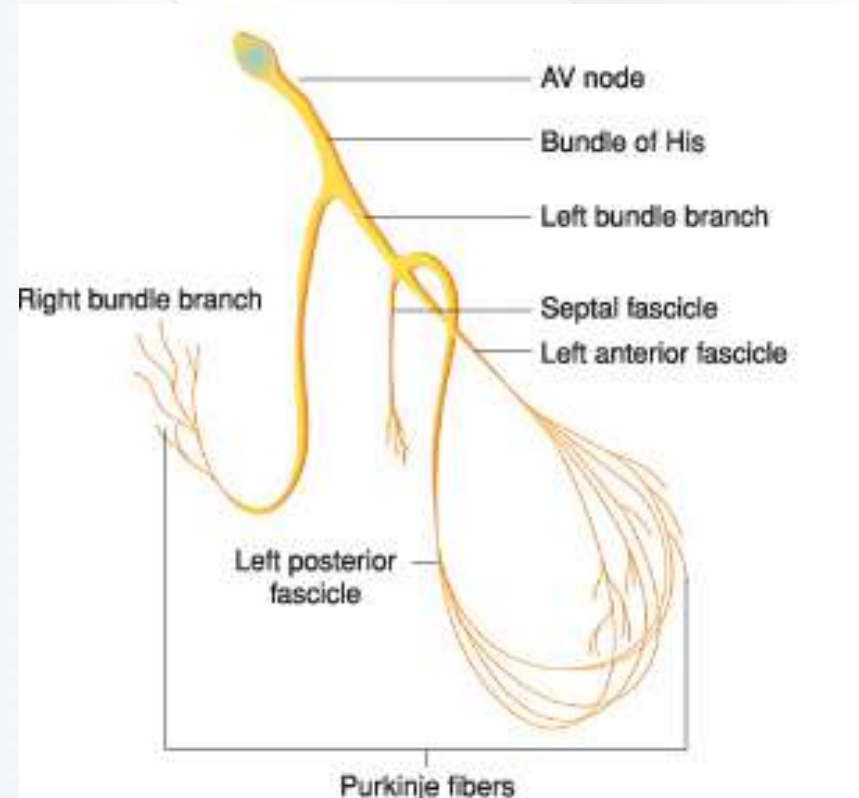
Left Ventricular Hypertrophy

- Increased R wave amplitude in precordial leads over LV
- S waves that are smaller in leads over LV (lead V_6) but larger in leads over RV (lead V_1)



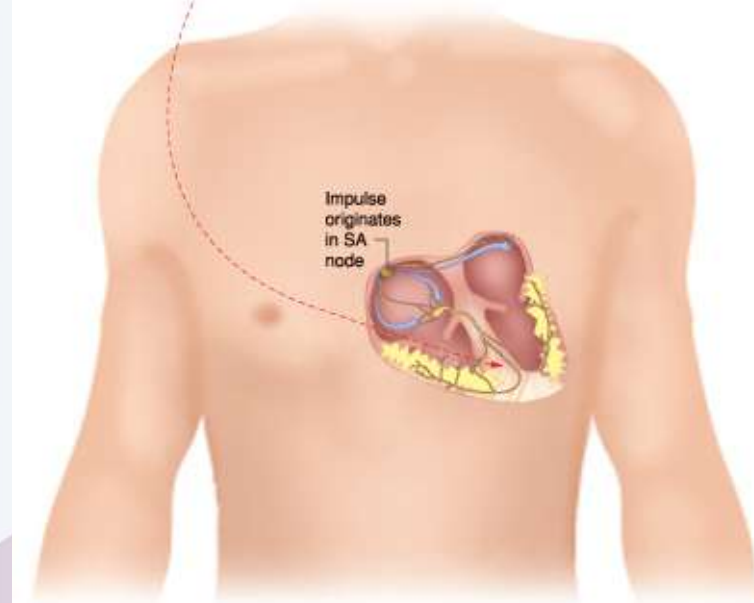
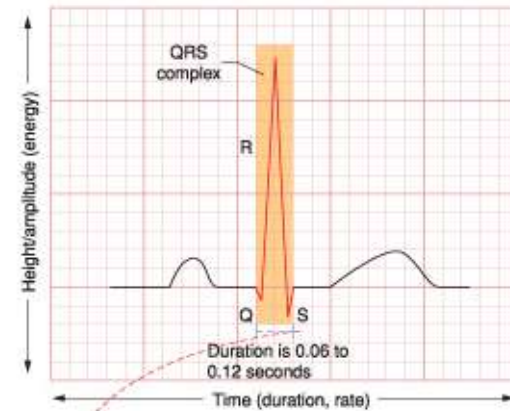
Bundle Branches

- Bundle of His divides into right and left bundle branches
- Left bundle branch divides into septal, anterior and posterior fascicles



Normal QRS Complex

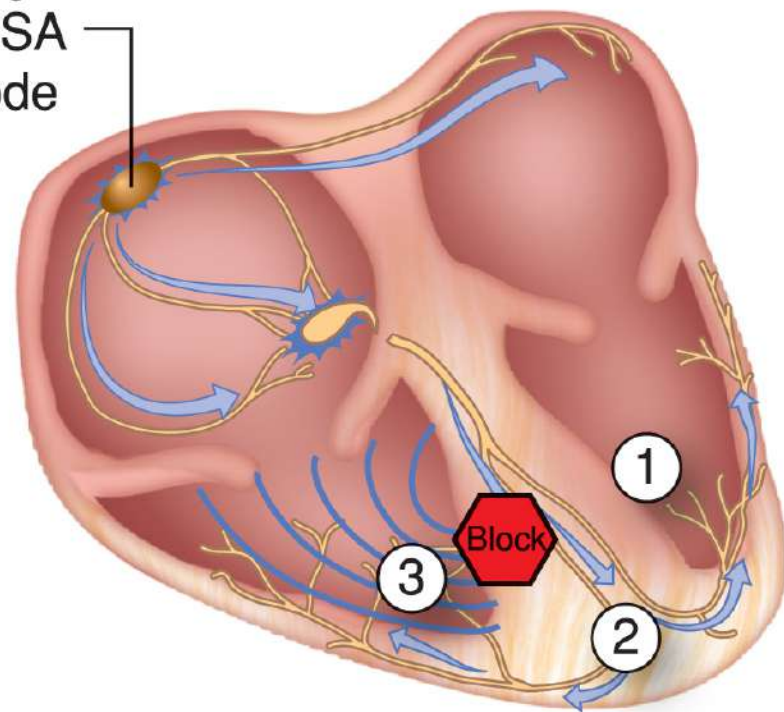
- Narrow - < 0.12 seconds in duration
- Electrical axis between 0° and $+90^\circ$



Bundle Branch Block

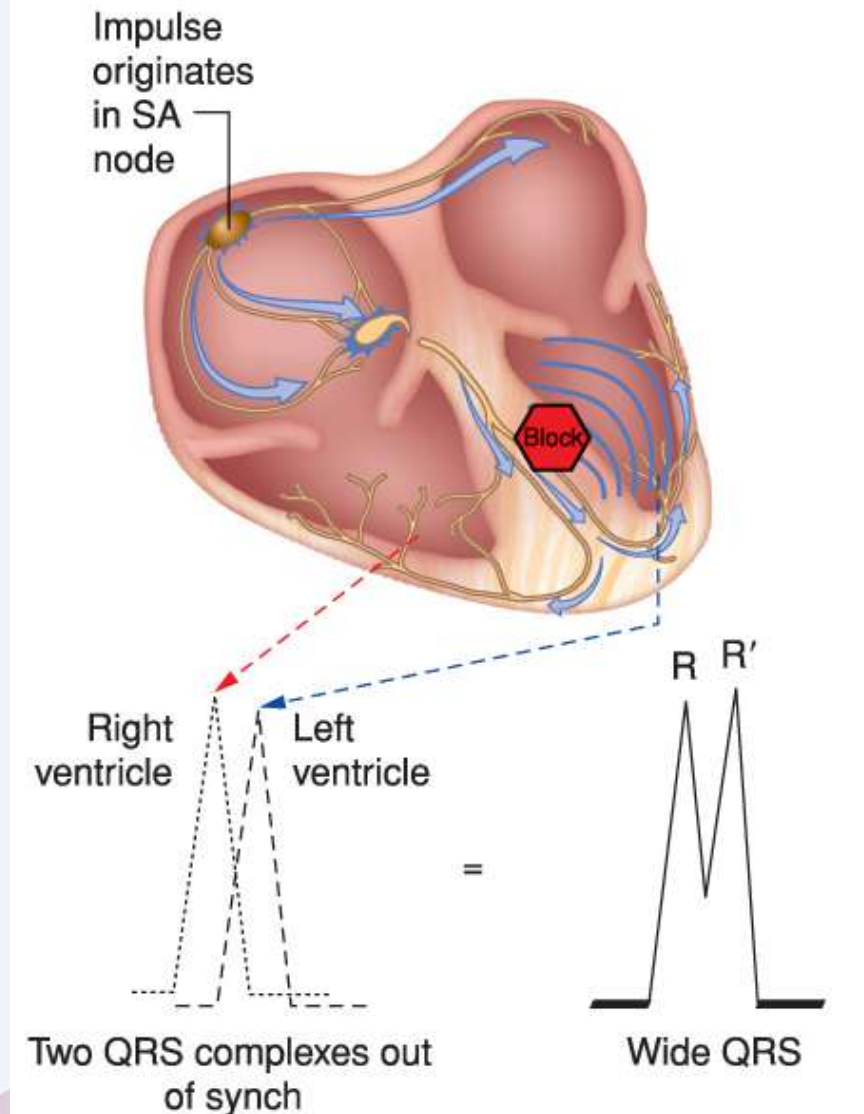
- Leads to one or both bundle branches failing to conduct impulses
- Produces delay in depolarization of the ventricle it supplies

Impulse originates in SA node



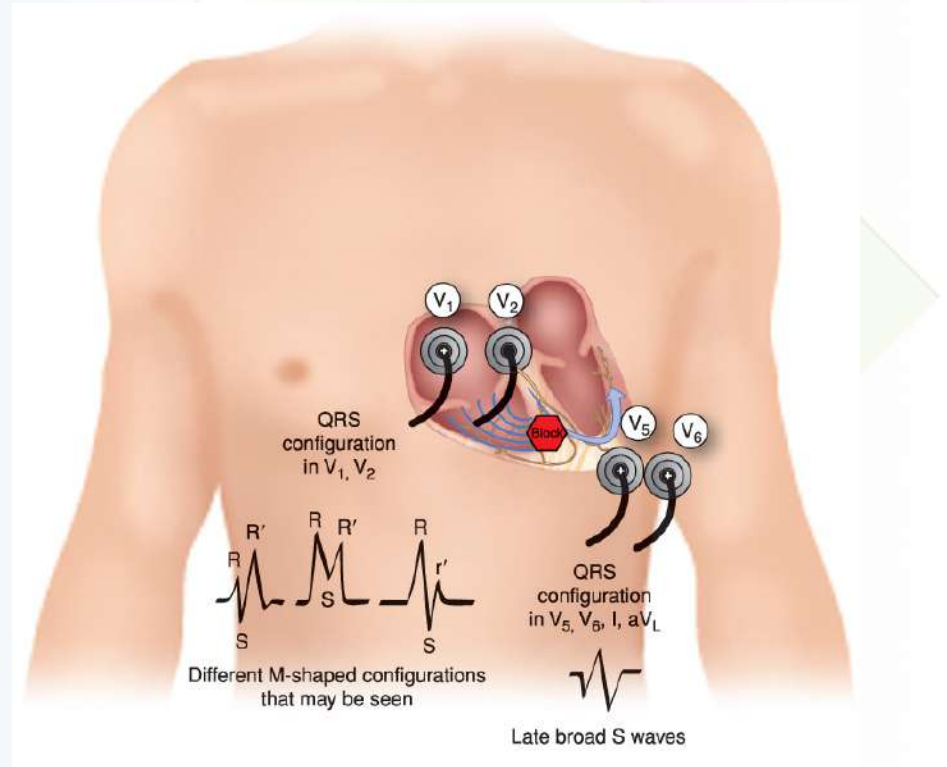
Bundle Branch Block

- Widened QRS complex
- RR' configuration in chest leads



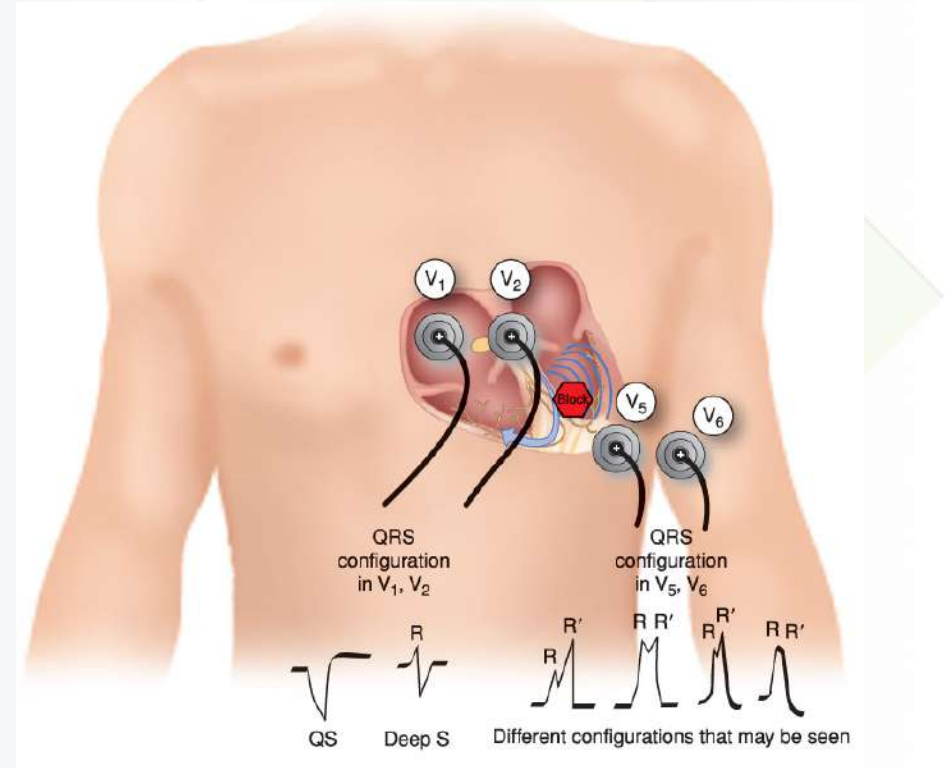
Right Bundle Branch Block

- Look for RR' in leads V_1 or V_2



Left Bundle Branch Block

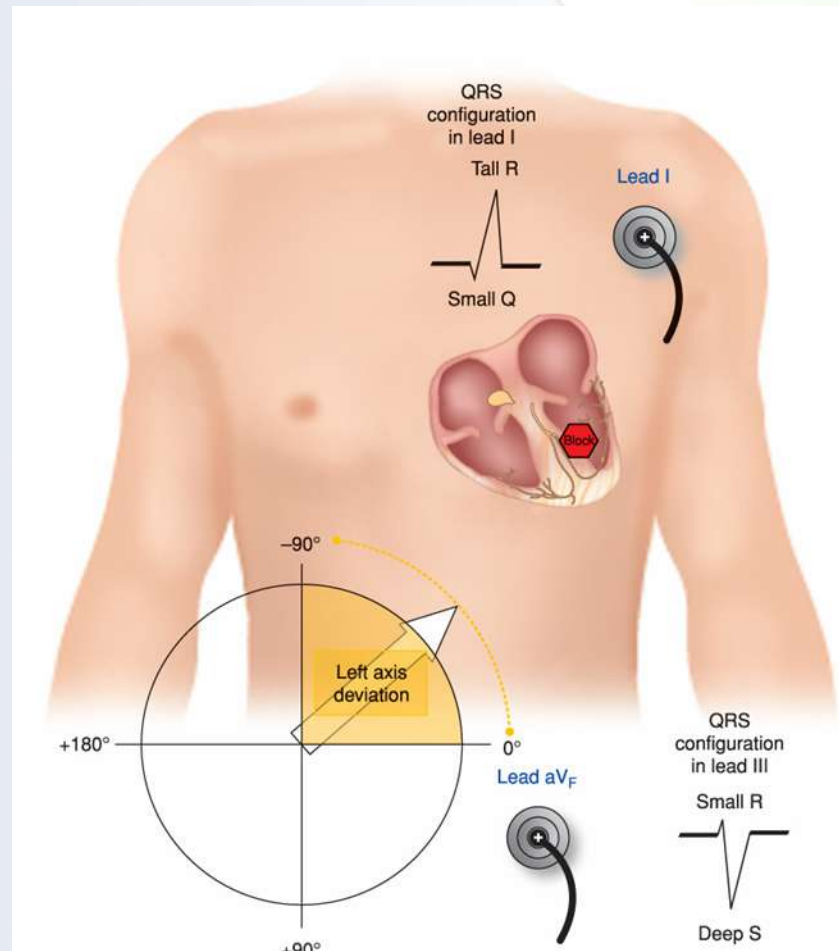
- Look for RR' in leads V₅ or V₆



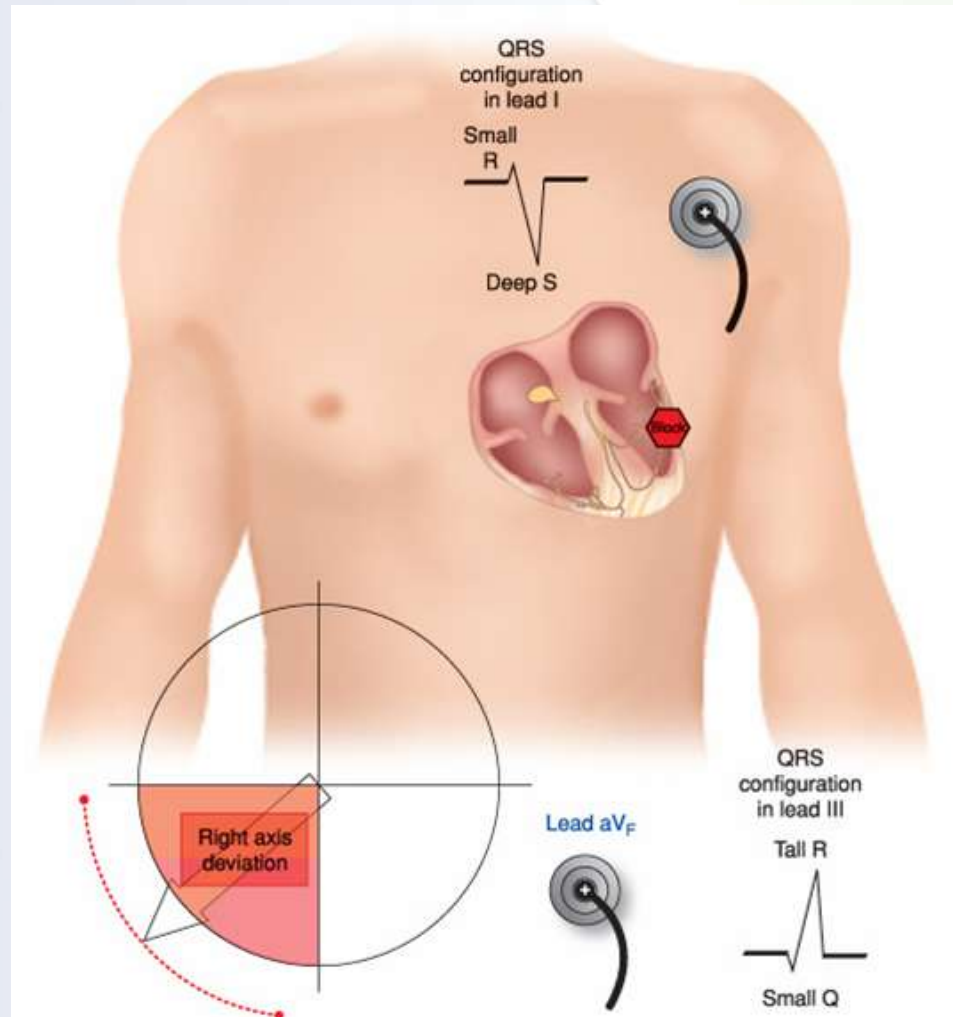
Hemiblocks

- Occur when one of fascicles of LBB blocked
- Key to detecting is a change in the QRS axis

Left Anterior Hemiblock



Left Posterior Hemiblock

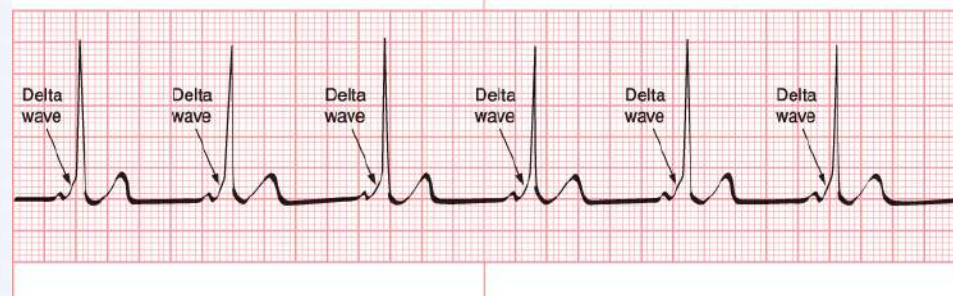
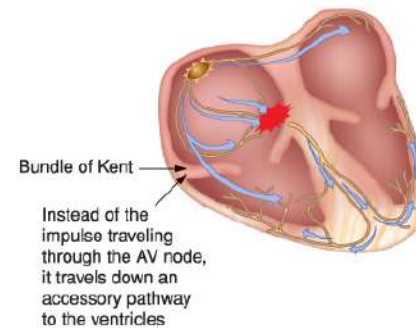


Preexcitation Syndrome

- Accessory conduction pathways sometimes exist between atria and ventricles
 - Bypass AV node and bundle of His and allow early depolarization of ventricles
- Results in a short PR interval

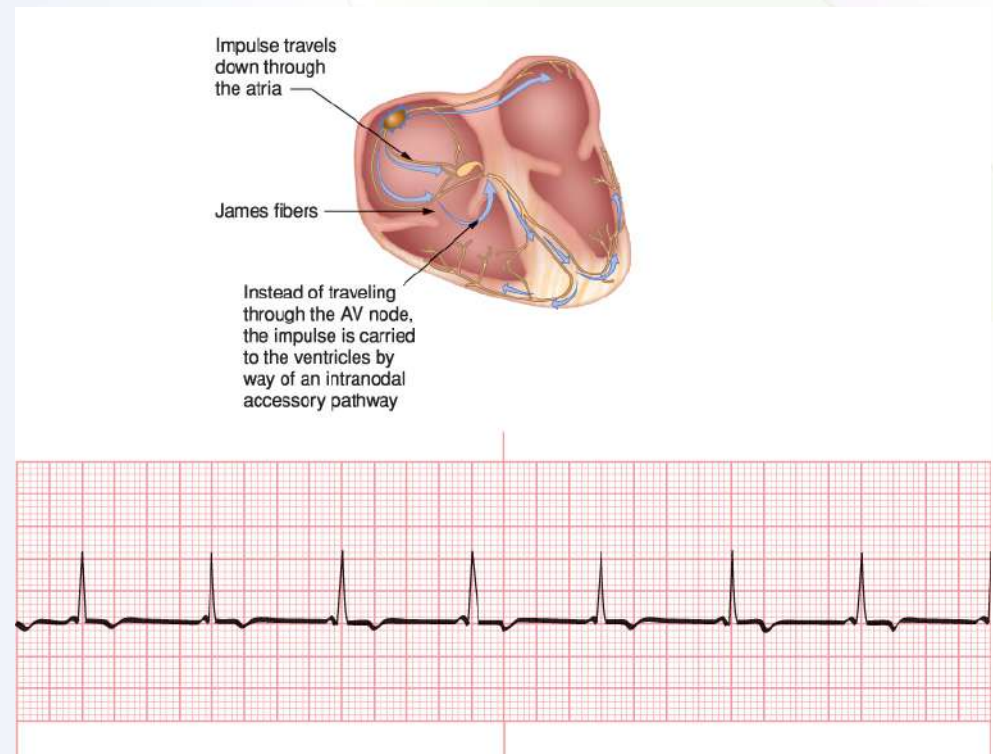
Wolff-Parkinson-White (WPW) Syndrome

- PR interval < 0.12 seconds
- Wide QRS complexes
- Delta wave seen in some leads
- Patients with WPW are vulnerable to PSVT



Lown-Ganong-Levine (LGL) Syndrome

- Intranodal accessory pathway bypasses normal delay in AV node
- PR interval < 0.12 seconds , normal QRS complex



Practice Makes Perfect

- Determine the type of condition

For the following 12-lead ECG, identify if any of the following is present: right and/or left atrial enlargement, right and/or left ventricular hypertrophy, right or left bundle branch block, left anterior hemiblock, left posterior hemiblock, and/or Wolff-Parkinson-White (WPW) syndrome or Lown-Ganong-Levine (LGL) syndrome.



Practice Makes Perfect

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Summary

- In hypertrophy the muscular wall of the ventricle(s) becomes thicker than normal.
- Dilation or enlargement of a chamber occurs because of volume overload where the chamber dilates to accommodate the increased blood volume.
- Enlargement is associated with the atria while hypertrophy is associated with the ventricles.

Summary

- The P wave is used to assess for atrial enlargement.
- The QRS complex is examined to identify ventricular hypertrophy.
- Indicators of enlargement or hypertrophy include an increase in the duration of the waveform, an increase in the amplitude of the waveform and axis deviation.
- Leads II and V_1 provide the necessary information to assess atrial enlargement.

Summary

- Diagnosis of right atrial enlargement is made when there is an increase in the amplitude of the first part of the P wave.
- Two indicators of left atrial enlargement are (1) increased amplitude in the terminal portion of the P in V_1 (2) increased duration or width of the P wave.
- In limb leads, right axis deviation is most common characteristic seen with right ventricular hypertrophy.

Summary

- In precordial leads, right ventricular hypertrophy causes the R waves to be more positive in leads which lie closer to lead V_1 .
- Left ventricular hypertrophy is identified by increased R wave amplitude of those precordial leads overlying the left ventricle and S waves that are smaller in the leads overlying the left ventricle (lead V_6) but larger in the leads (lead V_1) overlying the right ventricle.

Summary

- Bundle branch block is a disorder that leads to one or both of the bundle branches failing to conduct impulses. This produces a delay in the depolarization of the ventricle it supplies.
- In bundle branch block a widened QRS complex and a RR' configuration is seen in the chest leads.
- To diagnose right bundle branch block check for an RR' in the right chest leads; leads V_1 or V_2 .

Summary

- To diagnose left bundle branch block check for an R, R' in leads V_5 or V_6 .
- Hemiblocks cause axis deviation.
- Preexcitation syndromes occur in some persons because accessory conduction pathways exist between the atria and ventricles which bypass the AV node and bundle of His and allow the atria to depolarize the ventricles earlier than usual.

Summary

- Criteria for WPW include a PR interval less than 0.12 seconds, wide QRS complexes and a Delta wave seen in some leads.
- In LGL there is an intranodal accessory pathway that bypasses the normal delay within the AV node. This produces a PR interval less than 0.12 seconds and a normal QRS.