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QRS Complexes

Fast & Easy ECGs – A Self-Paced
Learning Program

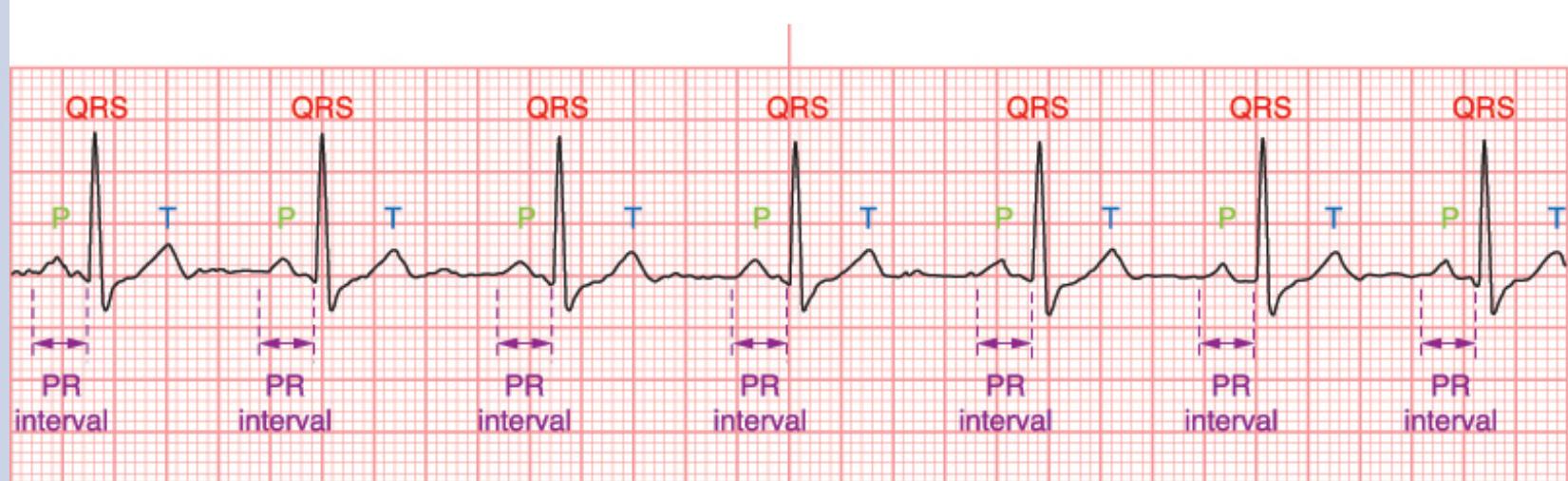
Q

I

A

ECG Waveforms

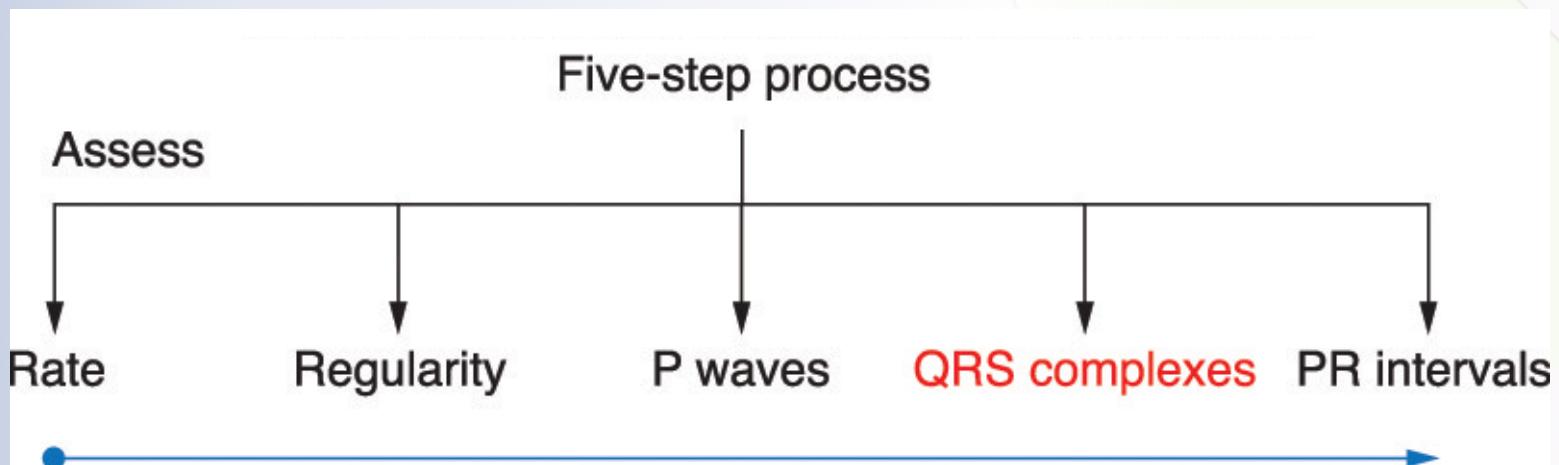
- Normally the heart beats in a regular, rhythmic fashion producing a P wave, QRS complex and T wave



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Step 4 of ECG Analysis

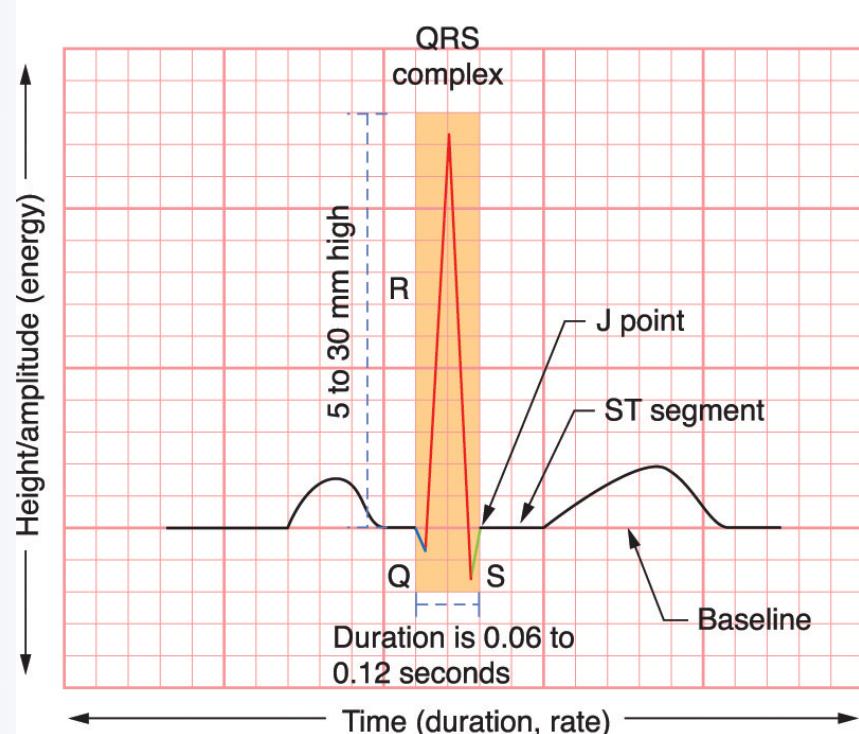
- Examining the QRS complexes



(Q)
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QRS Complex

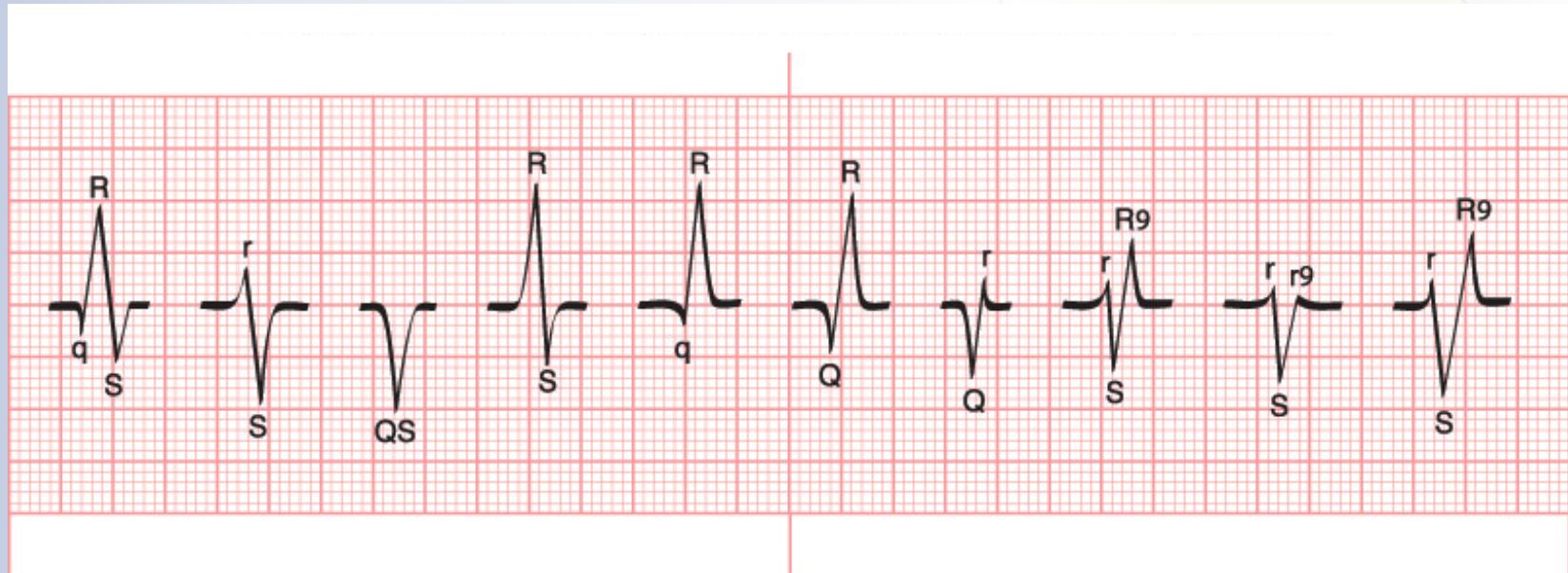
- **Q wave**
 - first negative deflection from the baseline following the P wave
- **R wave**
 - first positive deflection following the Q wave
- **S wave**
 - first negative deflection that extends below the baseline following the R wave



Common QRS Complex Configurations

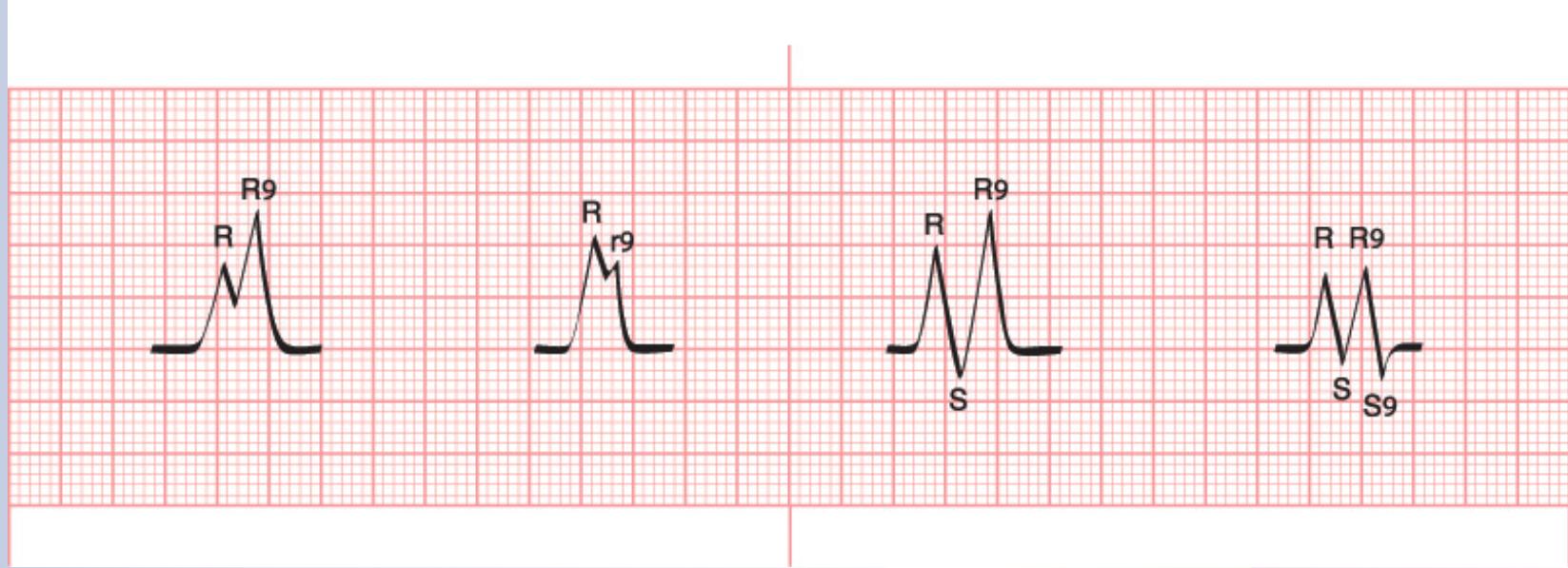
- Usually the QRS complex consists of positive (upright) deflections called R waves and negative (inverted) deflections called Q and S waves
- If there is no R wave, the complex is called a QS complex
- If there is no Q wave, the complex is called an RS complex

Common QRS Complex Configurations



Variations in the QRS Complex

- While there is only one Q wave there can be more than one R and S wave



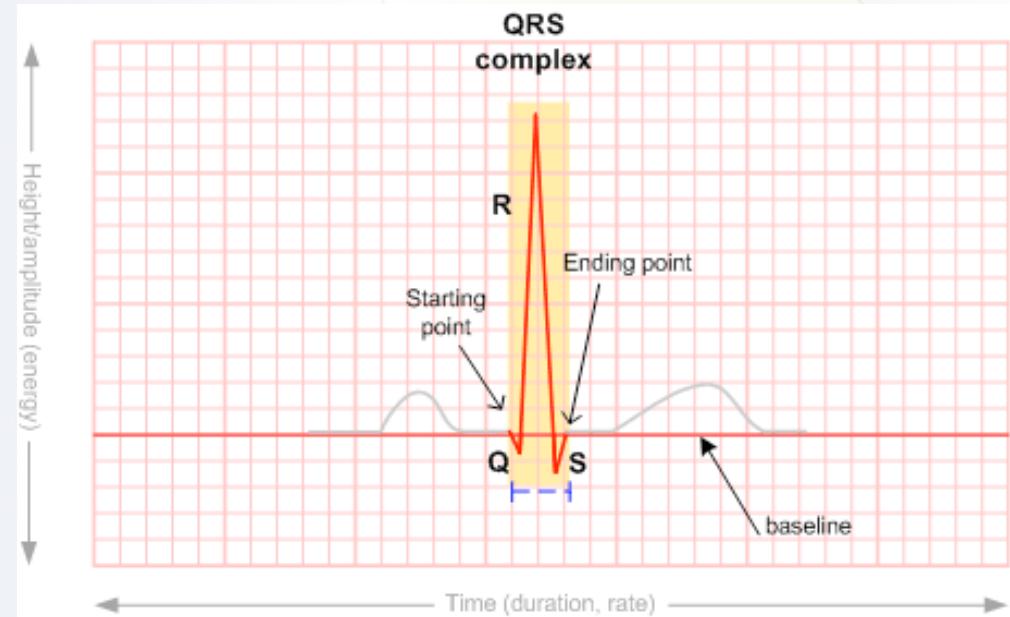
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Examining QRS Complexes

- Look closely at their characteristics, especially their location, configuration, and deflection

Measuring QRS Complexes

- Starting point is where first wave of complex starts to move away from baseline
- Ending point is where last wave of complex begins to level out (flatten) at, above, or below the baseline

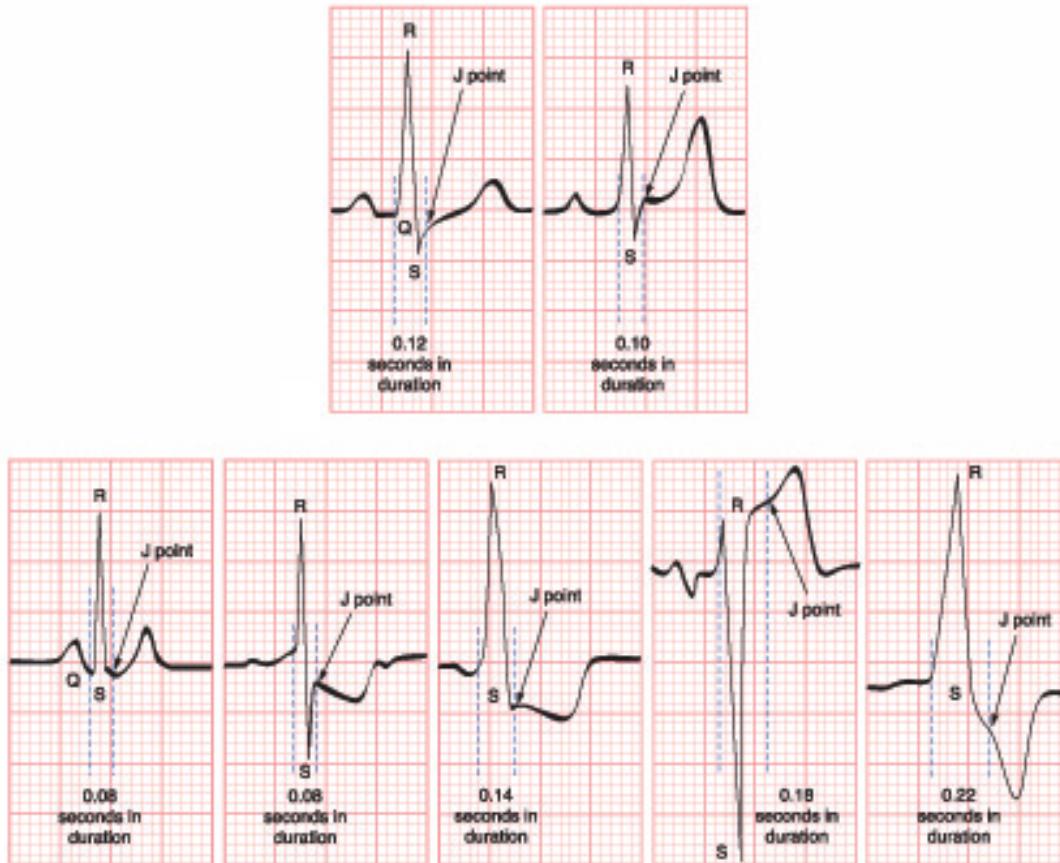


Measuring the QRS Complex

- Determining where the QRS complex ends can be difficult as sometimes there isn't a clear transition
- Measurement of the QRS complex should include the entire S wave but it shouldn't overlap into the ST segment or the T wave

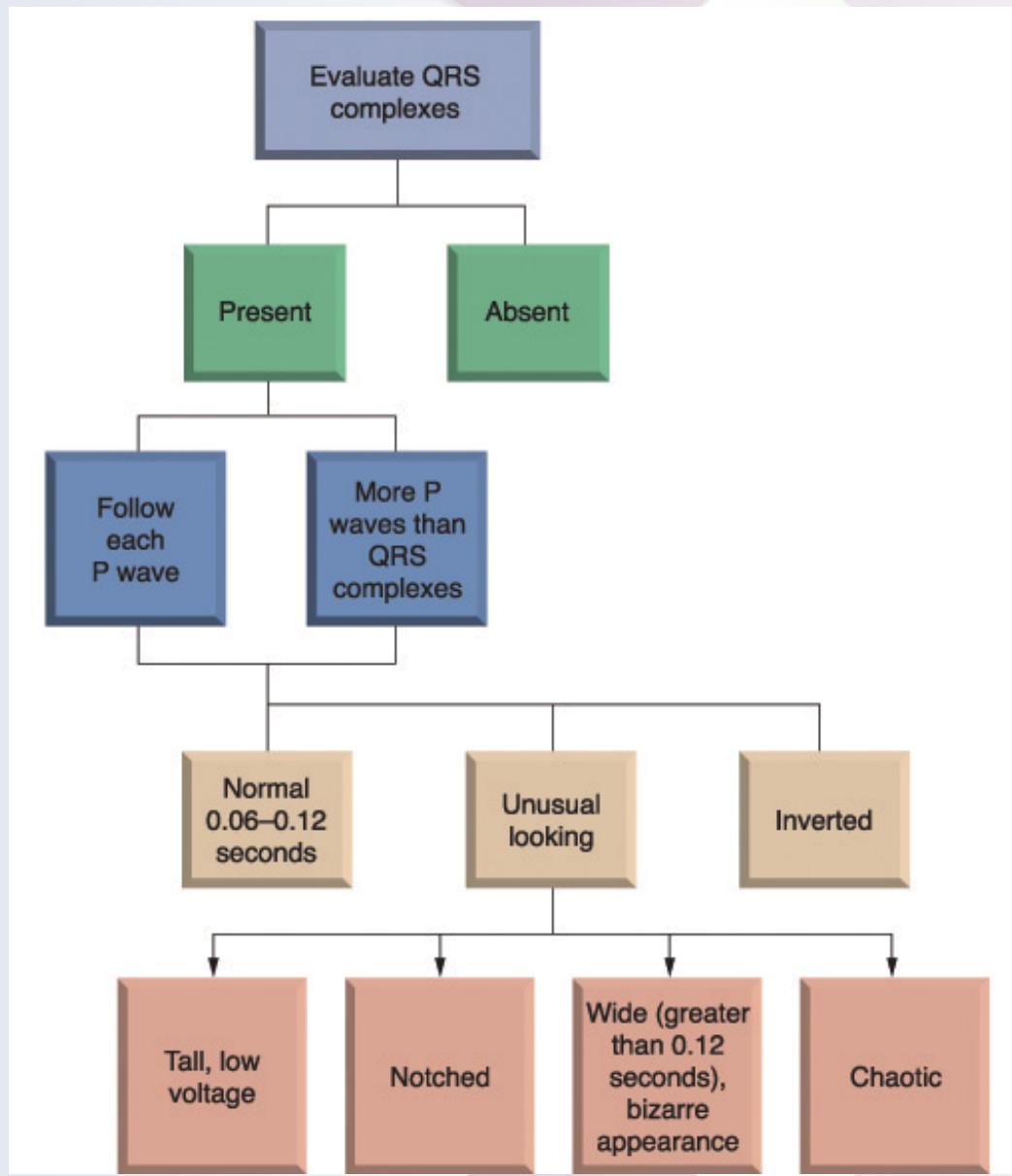
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Measuring the QRS Complex



Evaluating QRS Complexes

- Identifying the QRS complexes and determining whether they are normal or abnormal helps determine what rhythm the patient may be experiencing

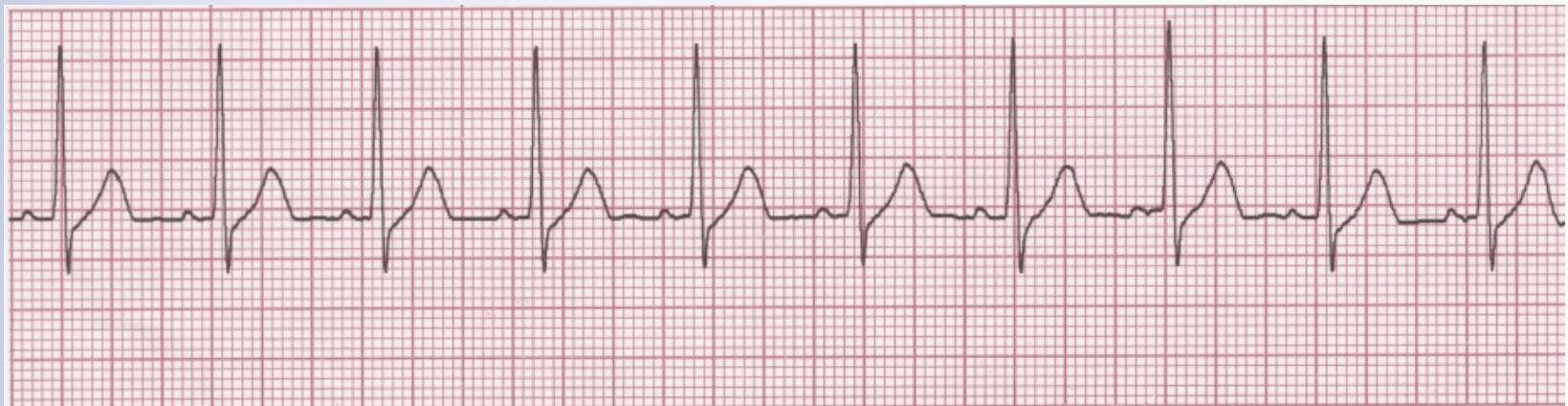


Normal QRS Complexes

- QRS complexes should appear normal (upright and narrow) if:
 - the rhythm is initiated from a site above the ventricles
 - conduction has progressed normally from the bundle of His, through the right and left bundle branches, and through the Purkinje network
 - normal depolarization of the ventricles has occurred

Normal QRS Complexes

- Seen with normal sinus rhythm and dysrhythmias that arise from above the ventricles
 - Unless there is a conduction delay through the ventricles or other type of abnormality

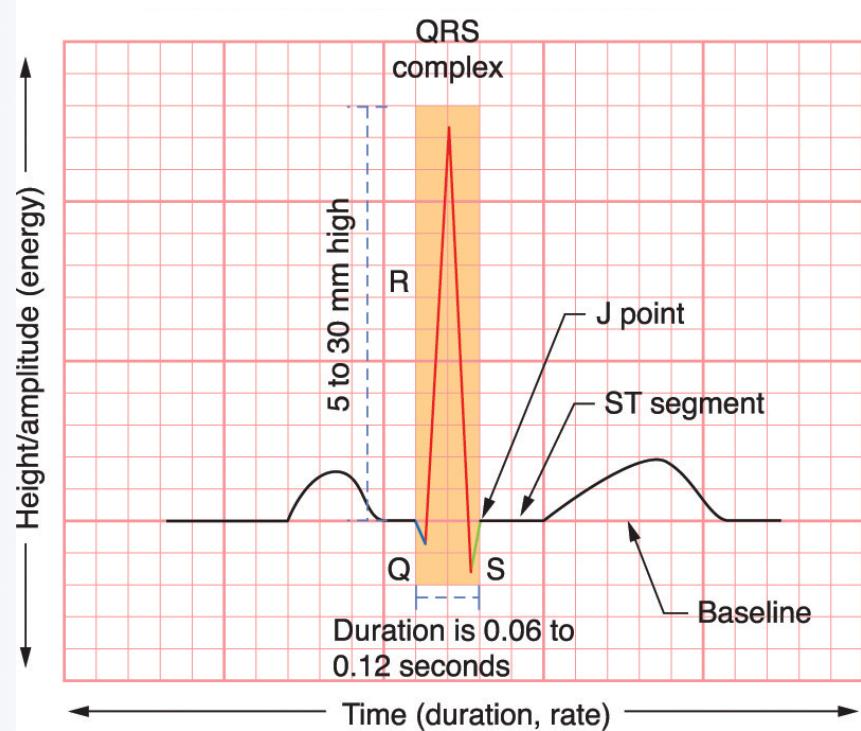


Abnormal QRS Complexes

- Produced by abnormal depolarization of the ventricles
- Pacemaker site in these abnormal QRS complexes can be the SA node, or an ectopic pacemaker in the atria, AV junction, bundle branches, Purkinje network, or ventricular myocardium

Abnormal QRS Complexes

- The shape of an abnormal QRS complex can vary from normal to wide and bizarre and/or slurred and notched

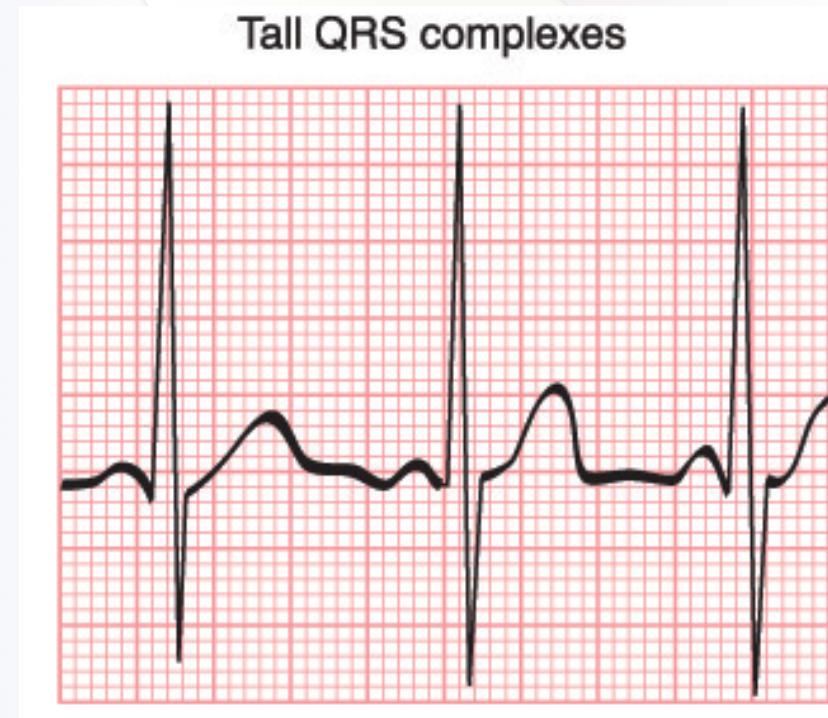


Abnormal QRS Complexes

- Caused by a number of factors including:
 - Ventricular hypertrophy
 - Intraventricular conduction disturbance
 - Aberrant ventricular conduction
 - Ventricular preexcitation
 - Ventricular ectopic or escape pacemaker
 - Ventricular pacing by cardiac pacemaker

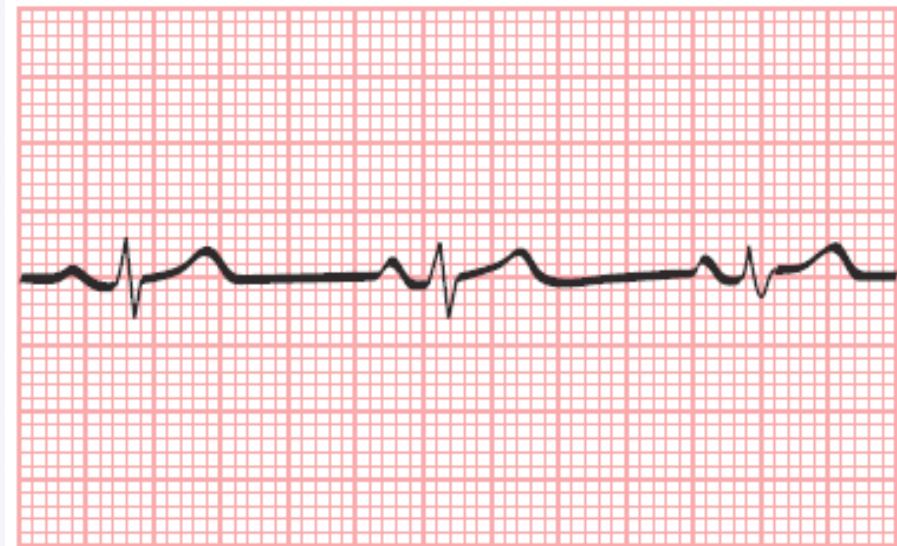
Tall QRS Complexes

- Usually caused by:
 - hypertrophy of one or both ventricles
 - an abnormal pacemaker
 - aberrantly conducted beat



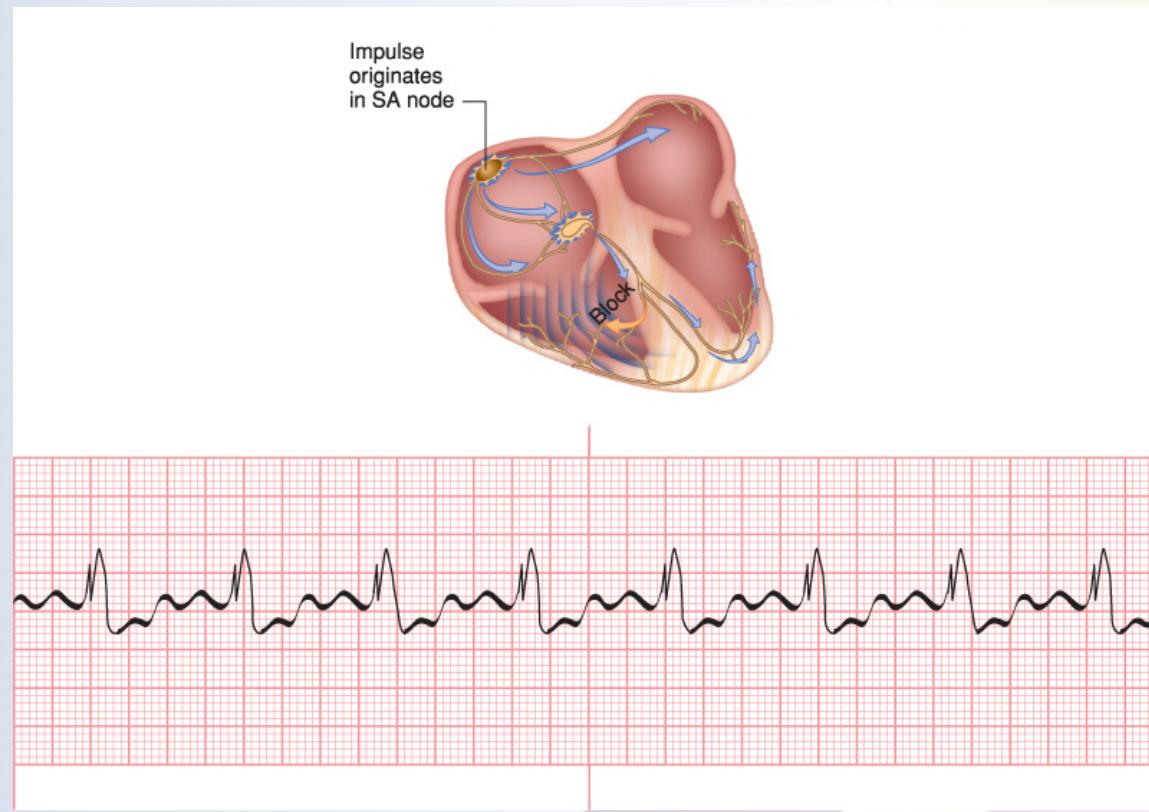
Low-Voltage QRS Complexes

- Seen in:
 - obese patients
 - hyperthyroid patients
 - pleural effusion



Wide-Bizarre QRS Complexes (of Supraventricular Origin)

- Often result from intraventricular conduction defect
- Typically a result of right or left bundle branch block



Aberrant Conduction

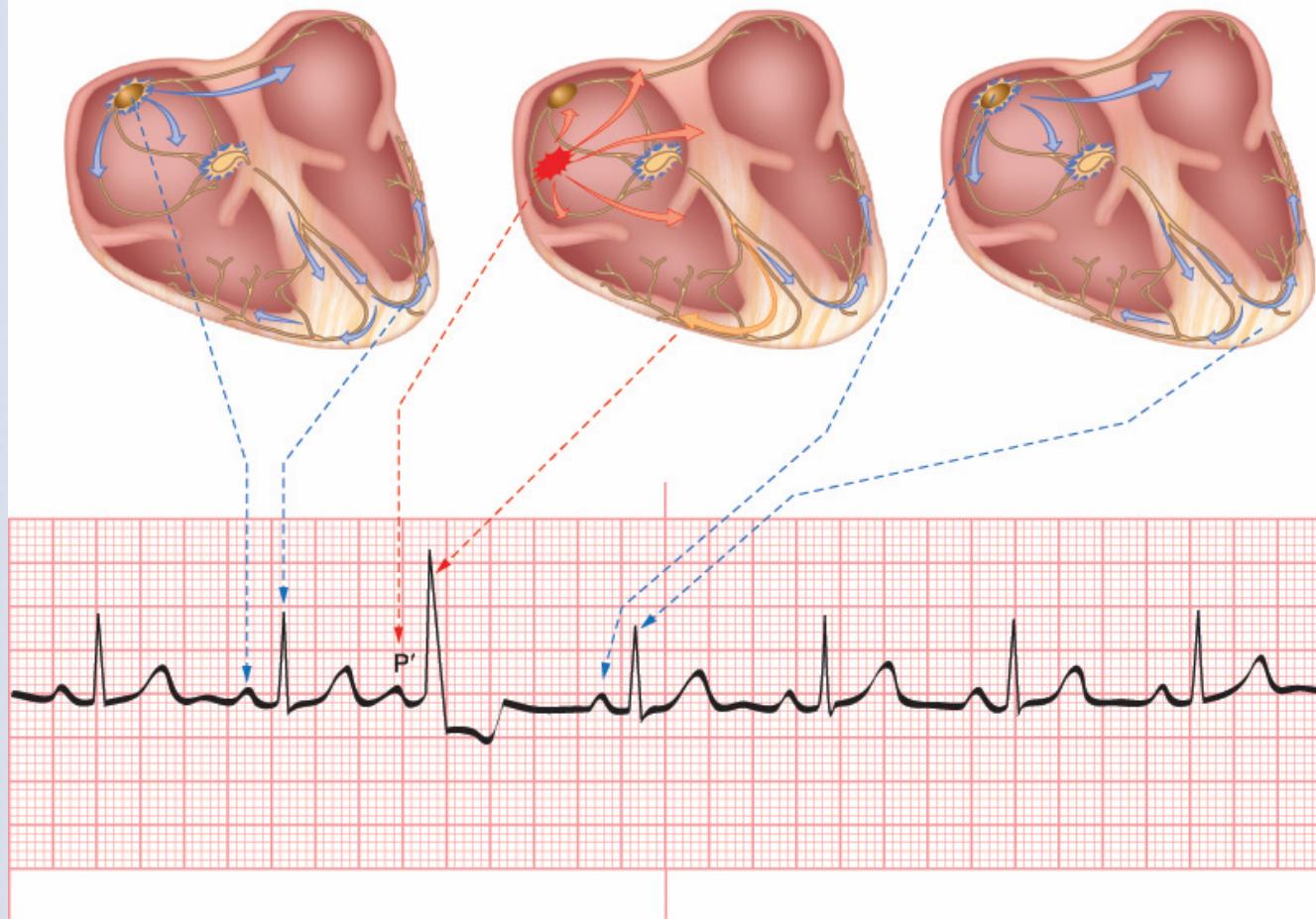
- Occurs when electrical impulses reach the bundle branch while it is still refractory after conducting a previous electrical impulse
- Results in the impulse traveling down the unaffected bundle branch followed by the stimulation of the other bundle branch
- Causes QRS complex to appear slightly wider than normal

Aberrant Conduction

Normally, the SA node initiates impulses, resulting in a repetitive cycle of P, QRS, and T waveforms.

Premature impulse travels down one of the bundle branches before the other.

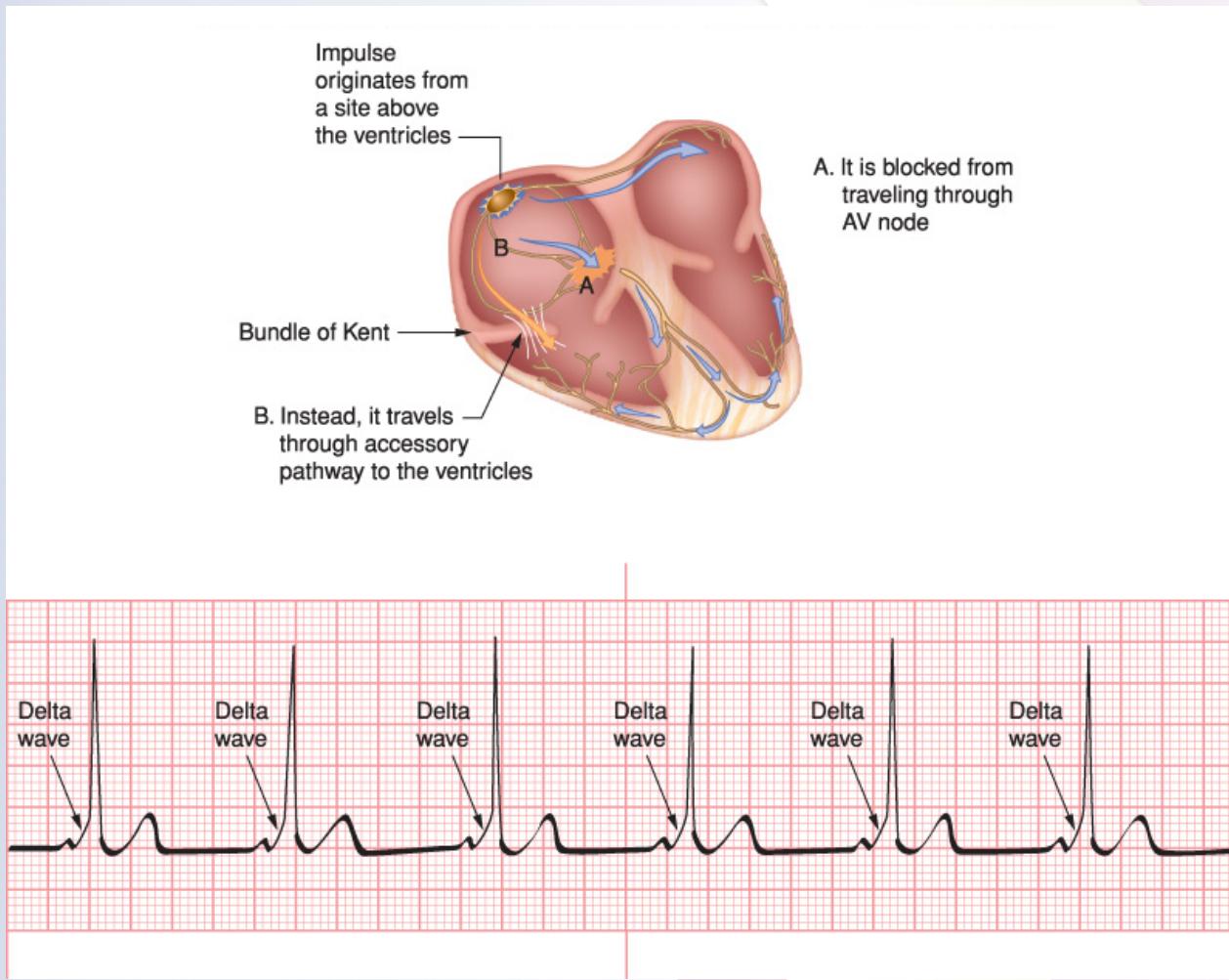
Following the premature beat, the SA node typically reinitiates impulses in the normal manner.



Ventricular Preexcitation

- Premature depolarization of the ventricles
- Occurs when an impulse arising from a supraventricular site travels through abnormal accessory conduction pathways to the ventricles
- May produce:
 - Wider than normal QRS complexes
 - Abnormal slurring at its onset (called the delta wave)

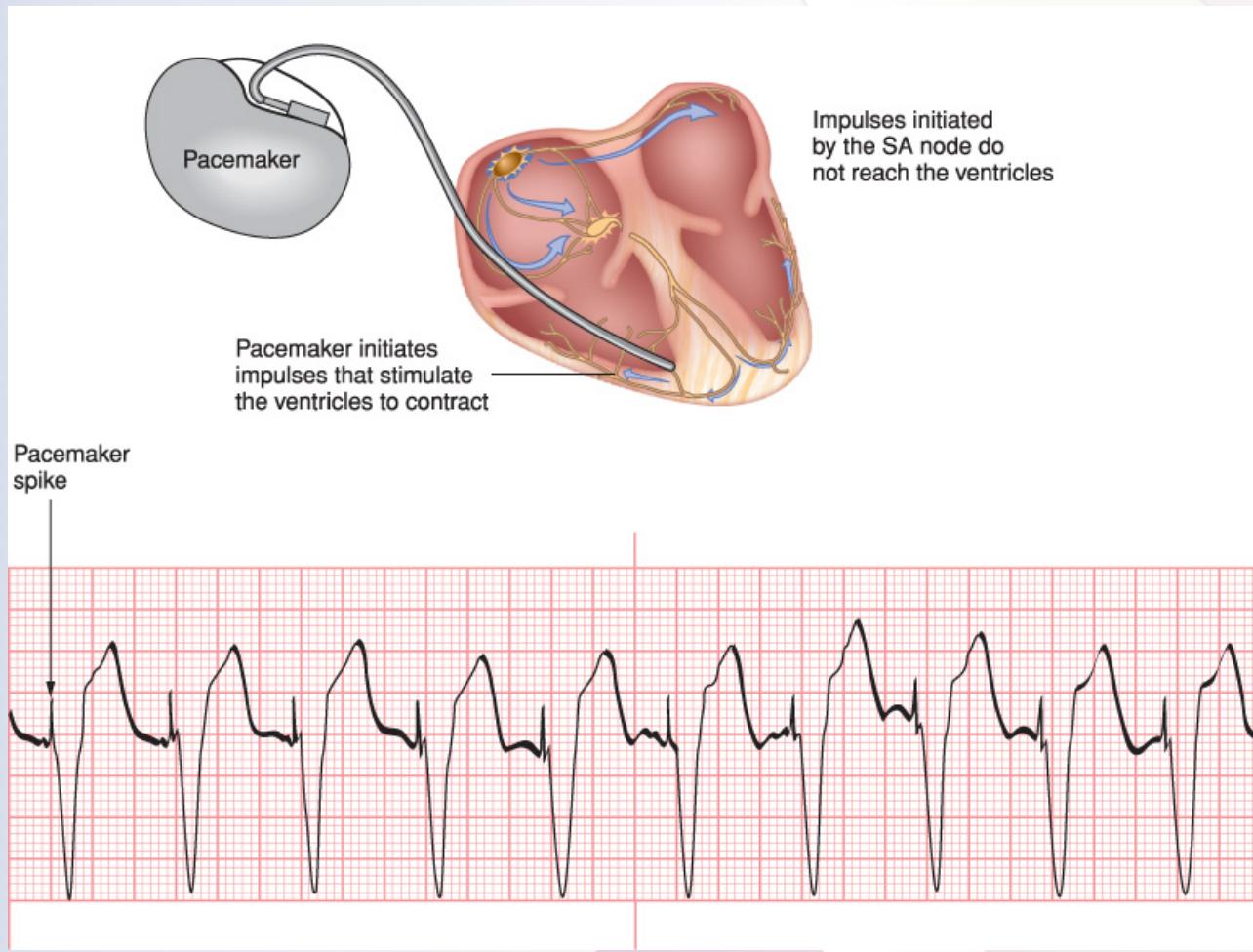
Ventricular Preexcitation



Cardiac Pacemaker-Induced QRS Complexes

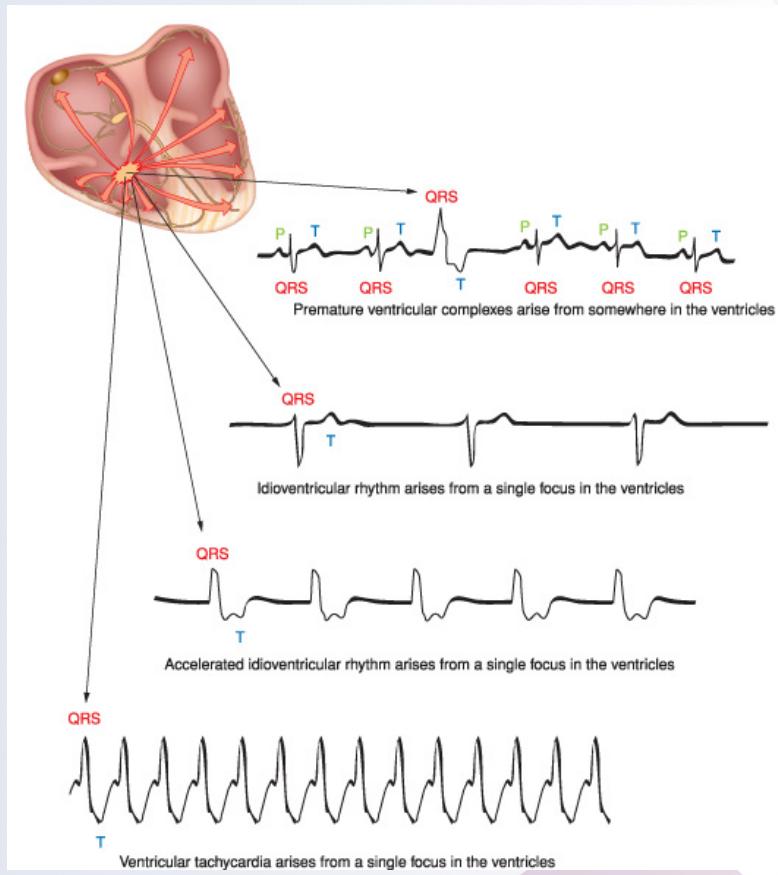
- Generally ≥ 0.12 seconds in width and appear bizarre
- Preceding each pacemaker-induced QRS complex is a pacemaker spike

Cardiac Pacemaker-Induced QRS Complexes



Ventricular Dysrhythmias

- Originate from the ventricular tissue



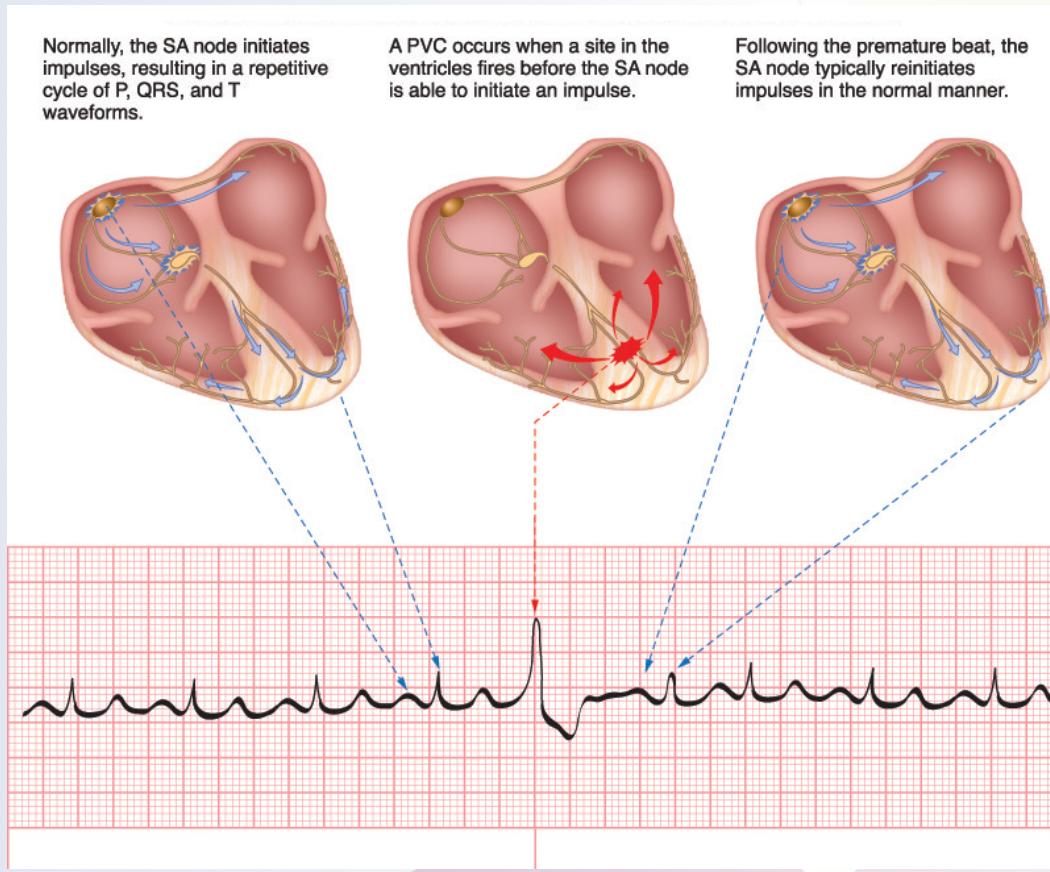
Wide QRS Complexes

- Key characteristic of ventricular dysrhythmias
- Bizarre-looking
- T wave that takes an opposite direction to R waves



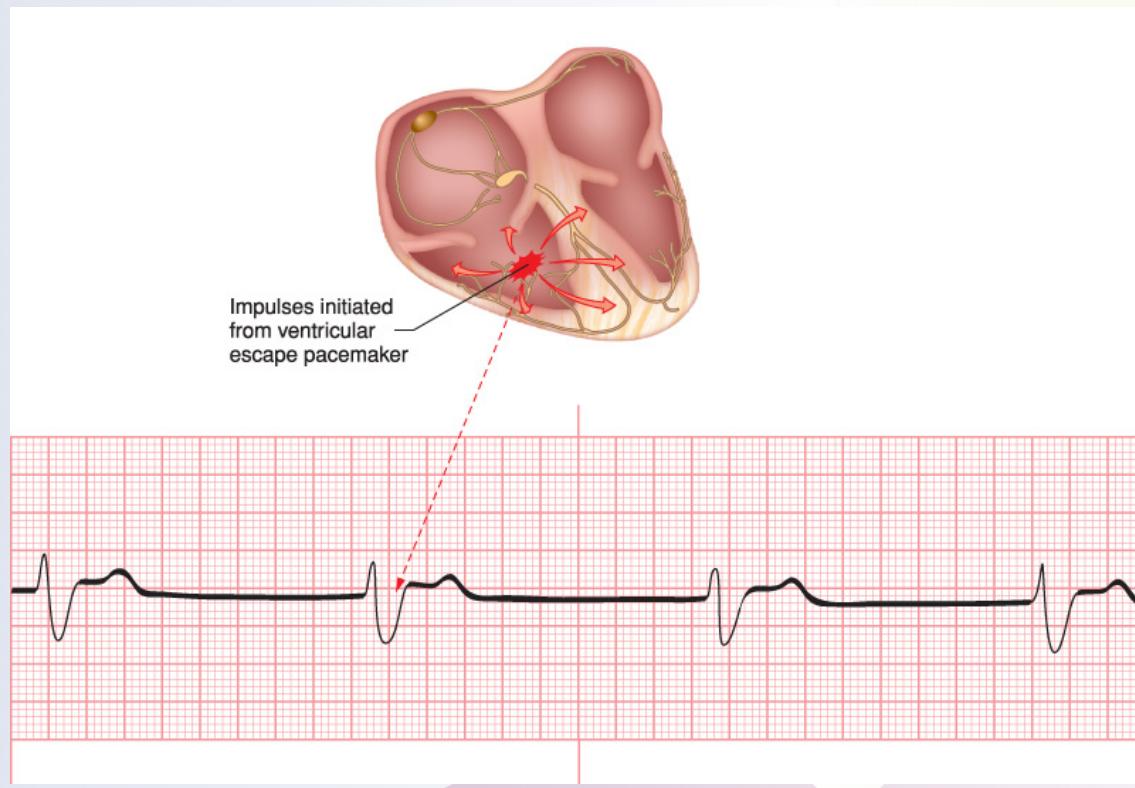
Wide QRS Complexes

- Premature Ventricular Complexes (PVCs) are early beats that arise from the ventricles before SA node can fire



Wide QRS Complexes

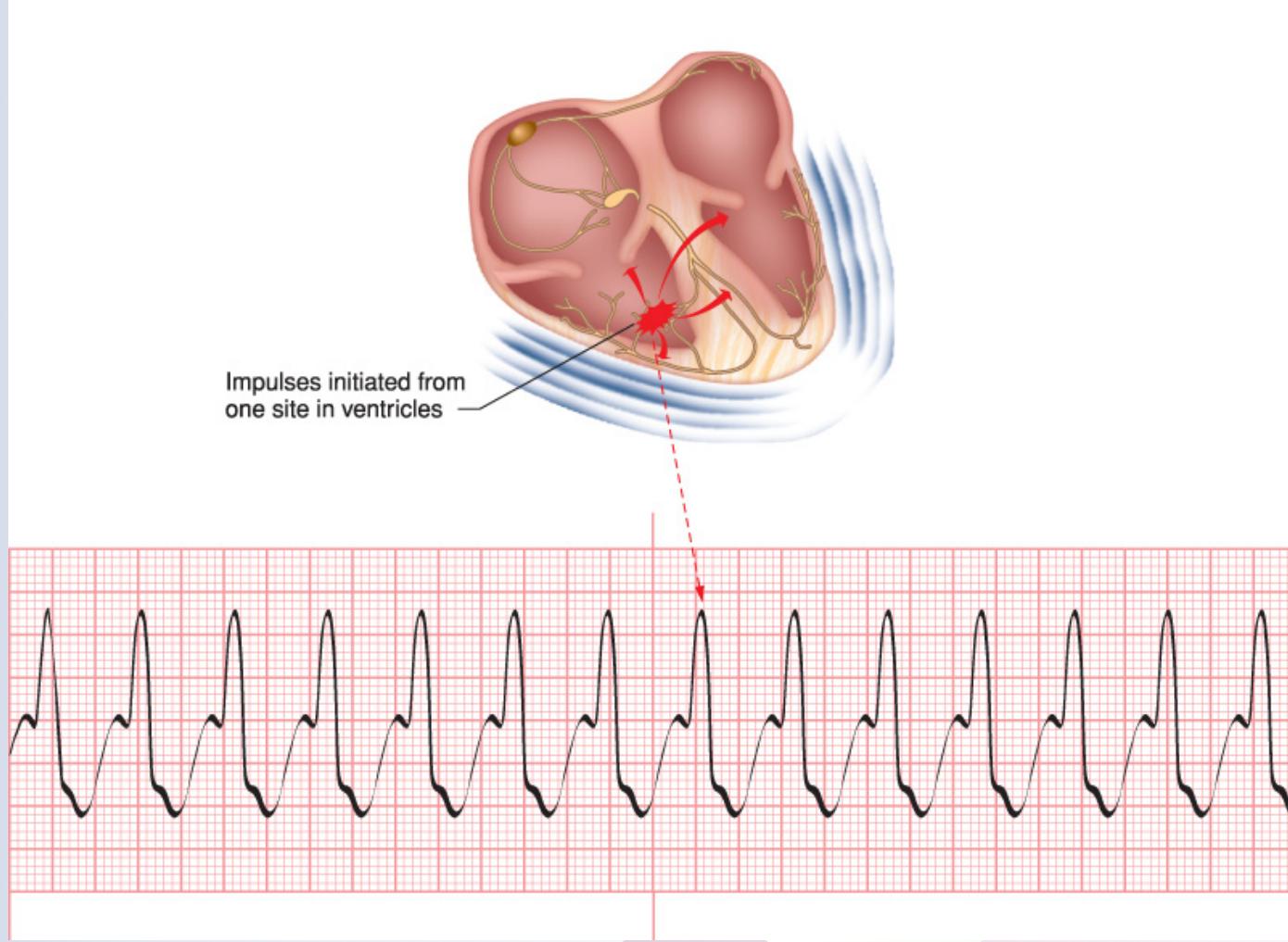
- Seen with idioventricular rhythm
 - A sustained escape rhythm having a rate of 20 to 40 beats per minute (may be slower)



Wide QRS Complexes

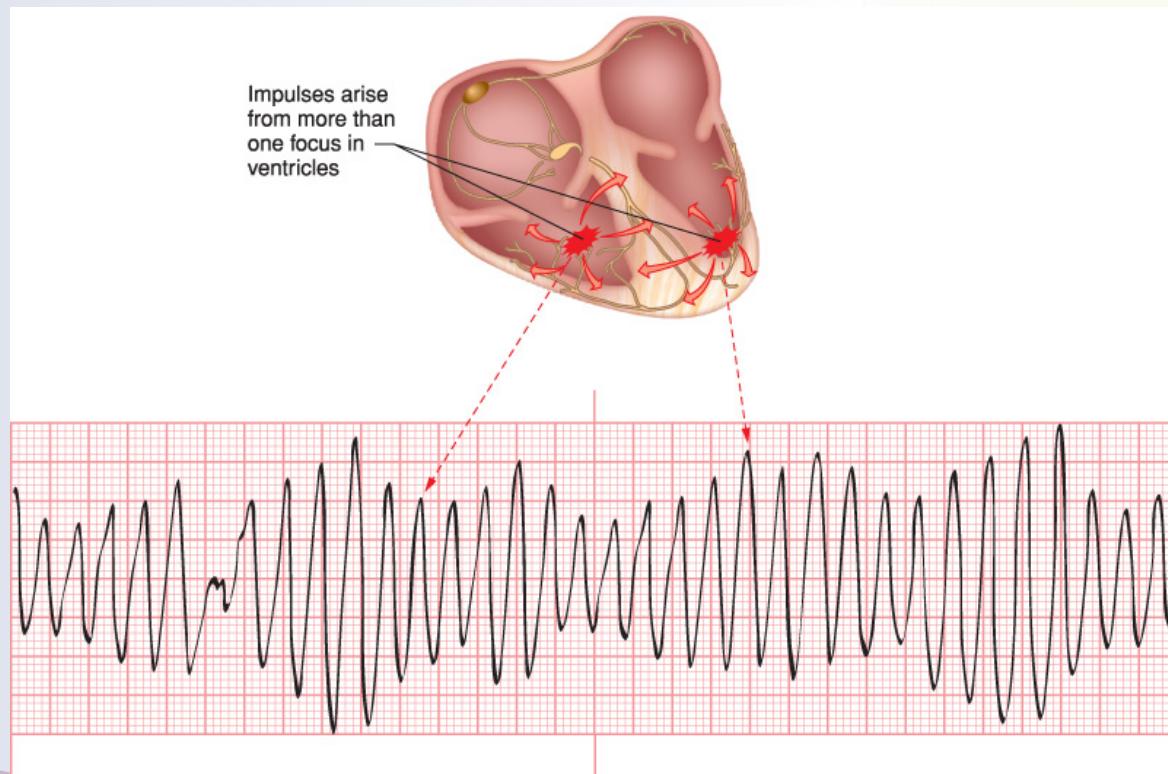
- Seen with ventricular tachycardia (VT)
 - Three or more PVCs in a row are considered ventricular tachycardia
 - May come in bursts of 6 to 10 complexes or be sustained
 - In sustained VT the heart rate is between 100 and 250 BPM

Wide QRS Complexes



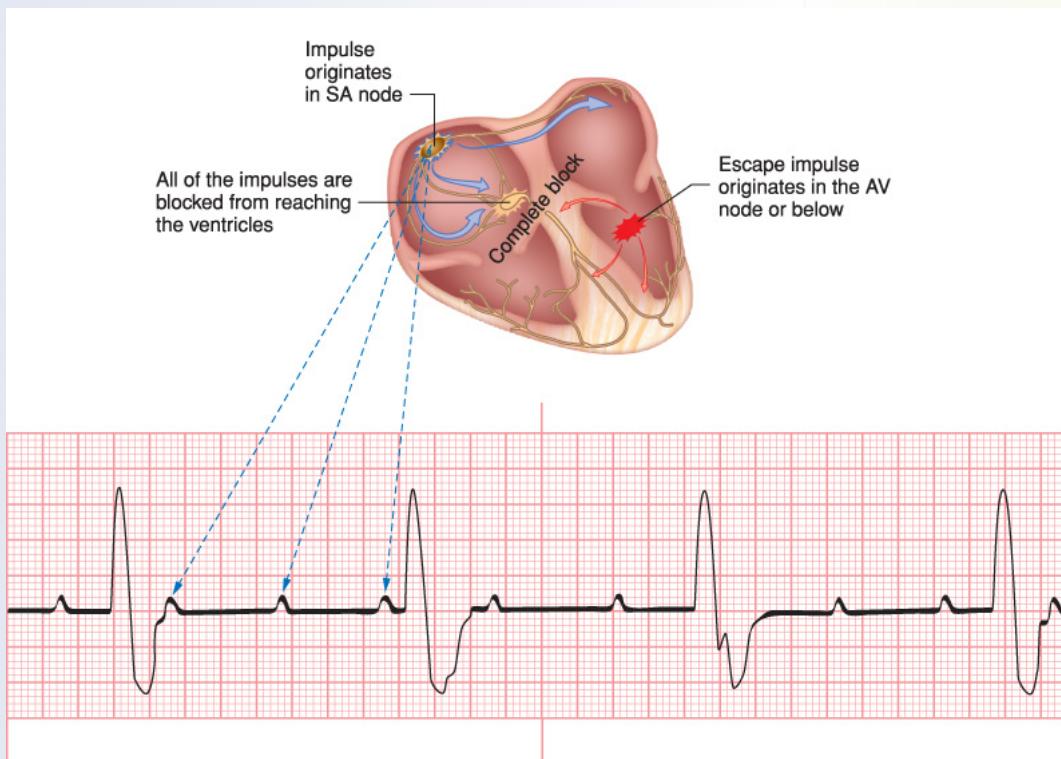
Changing Ventricular Waveforms

- Seen with torsades de pointes
 - Appears as a series of QRS complexes that rotate about the baseline between upright deflections and downward deflections
 - This produces a “spindle-like” appearance of the ECG rhythm



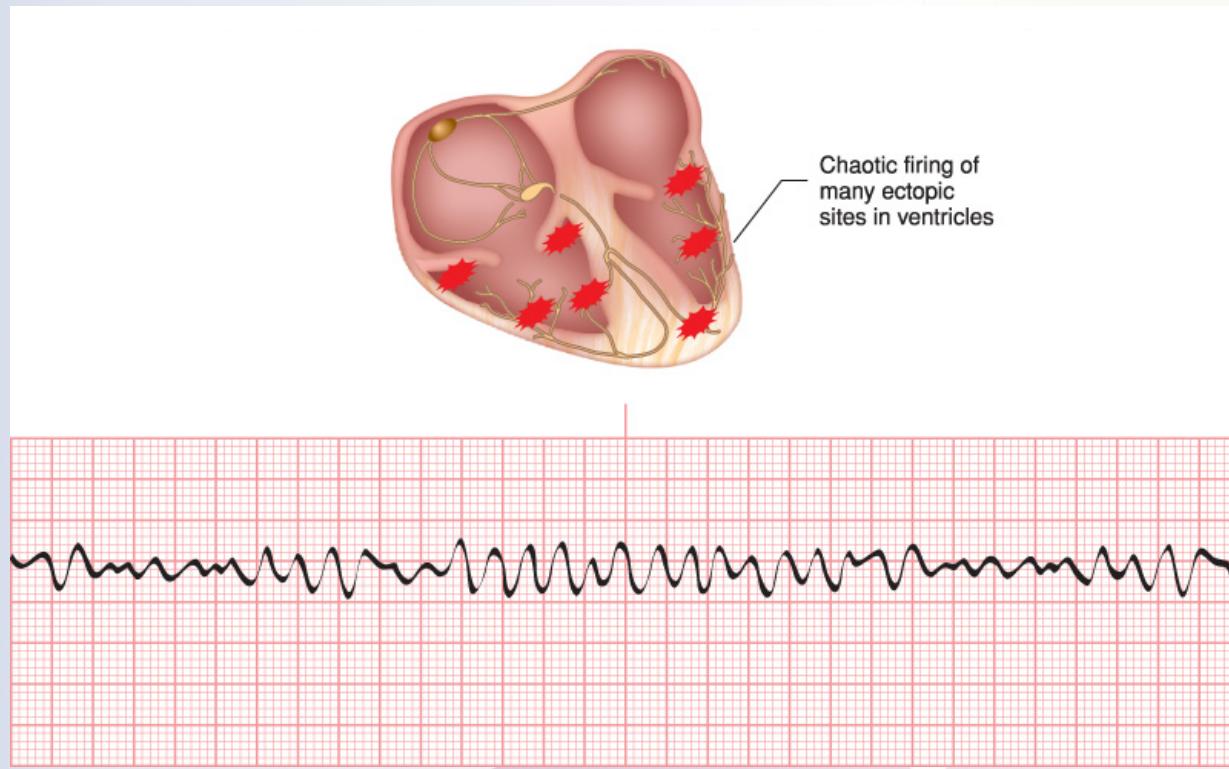
Wide QRS Complexes

- Seen in 3rd-degree AV heart block
 - Location of the ventricular escape pacemaker site determines appearance of the QRS complex



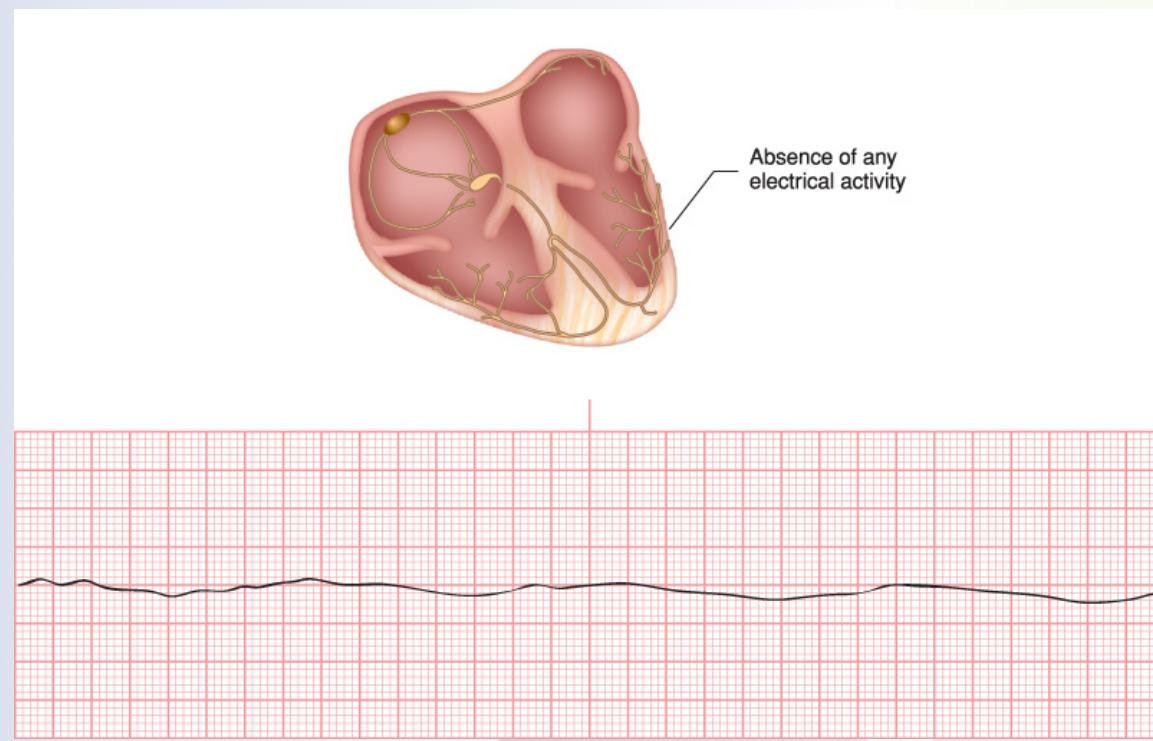
Chaotic Wavy Line

- Called ventricular fibrillation
- Represents erratic firing of multiple sites in the ventricles
- On ECG monitor it looks like a chaotic, wavy line with no discernible waveforms



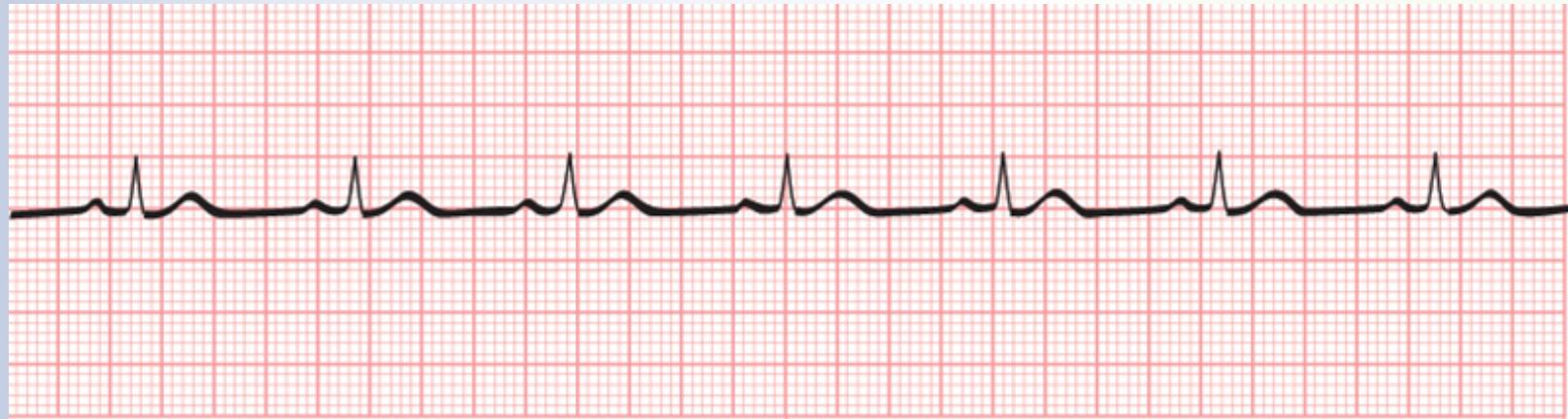
Flat (or Nearly Flat) Line

- Called asystole
- Represents lack of any cardiac activity in the ventricles
- Complete cessation of cardiac output



Practice Makes Perfect

- Determine the type of ventricular waveforms



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Practice Makes Perfect

- Determine the type of ventricular waveforms



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Practice Makes Perfect

- Determine the type of ventricular waveforms



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Practice Makes Perfect

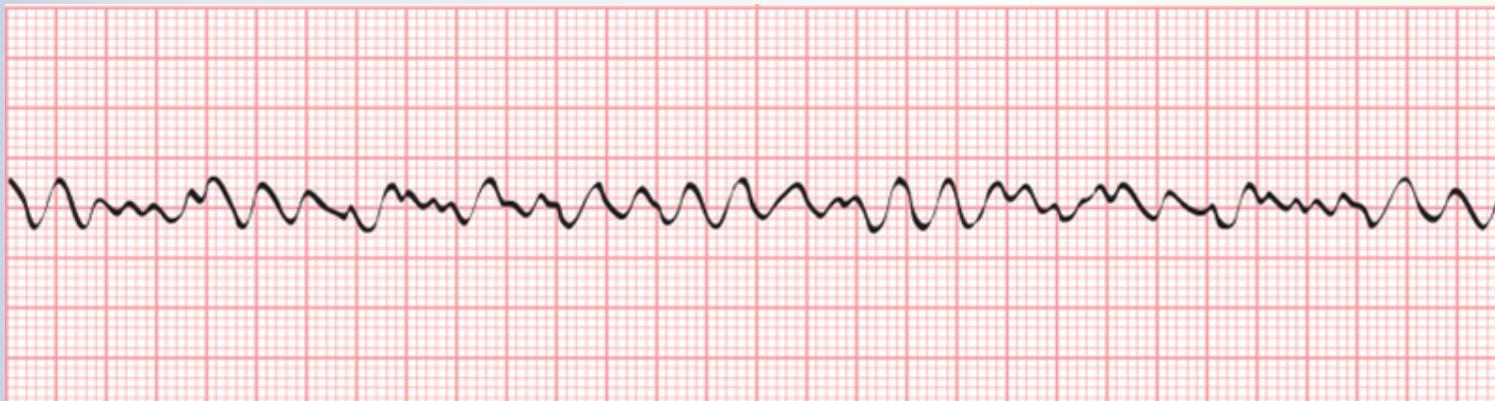
- Determine the type of ventricular waveforms



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Practice Makes Perfect

- Determine the type of ventricular waveforms



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Summary

- Fourth step of analyzing an ECG rhythm is examining the QRS complexes.
- QRS complex starts where first wave of complex starts to move away from the baseline. It ends at the point where the last wave of the complex transitions into the ST segment.
- QRS complex is larger than the P wave because ventricular depolarization involves a considerably larger muscle mass than atrial depolarization.

Summary

- Amplitude of a normal QRS is 5 to 30 mm and the duration is 0.06 to 0.12 seconds.
- Q wave is first negative deflection from baseline following the P wave.
- R wave is the first positive deflection following the Q wave (the P wave if Q wave is absent).
- S wave is first negative deflection that extends below the baseline in the QRS complex following the R wave.

Summary

- Normal sinus rhythm and dysrhythmias that arise from above the ventricles will usually have normal QRS complexes.
- Abnormal QRS complexes are produced by abnormal depolarization of the ventricles.
- Duration of an abnormal QRS complex is greater than 0.12 seconds.

Summary

- Shape of an abnormal QRS complex varies from almost normal to wide and bizarre and/or slurred and notched.
- Tall QRS complexes are usually caused by hypertrophy of one or both ventricles, or by an abnormal pacemaker or aberrantly conducted beat.
- Low voltage or abnormally small QRS complexes may be seen in obese patients, hyperthyroid patients and pleural effusion.

Summary

- Wide, bizarre QRS complexes of supraventricular origin are often the result of intraventricular conduction defect which usually occurs due to right or left bundle branch block.
- Wide QRS complexes may be seen in aberrant conduction, ventricular preexcitation and with a cardiac pacemaker.

Summary

- Wide, greater than 0.12 seconds in duration, QRS complexes are the key characteristic seen with ventricular dysrhythmias.
- With torsades de pointes the shape of the ventricular waveforms changes. It has a “spindle-like” appearance of the ECG rhythm.

Summary

- 3rd-degree AV heart block is another dysrhythmia where there may be abnormal QRS complexes.
- Ventricular fibrillation appears on ECG monitor as a chaotic wavy line, with no discernible waveforms.