



تخطيط القلب

الكهربائي

ECG

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Course Objectives

- To recognize the normal rhythm of the heart - “Normal Sinus Rhythm.”
- To recognize the 13 most common rhythm disturbances.
- To recognize an acute myocardial infarction on a 12-lead ECG.

Learning Modules

- ECG Basics
- How to Analyze a Rhythm
- Normal Sinus Rhythm
- Heart Arrhythmias
- Diagnosing a Myocardial Infarction

Arrhythmias

- Sinus Rhythms
- Premature Beats
- Supraventricular Arrhythmias
- Ventricular Arrhythmias
- AV Junctional Blocks

Sinus Rhythms

- *Sinus Bradycardia*
- *Sinus Tachycardia*

Rhythm #1



- Rate? 30 bpm
- Regularity? regular
- P waves? normal
- PR interval? 0.12 s
- QRS duration? 0.10 s

Interpretation? *Sinus Bradycardia*

Sinus Bradycardia



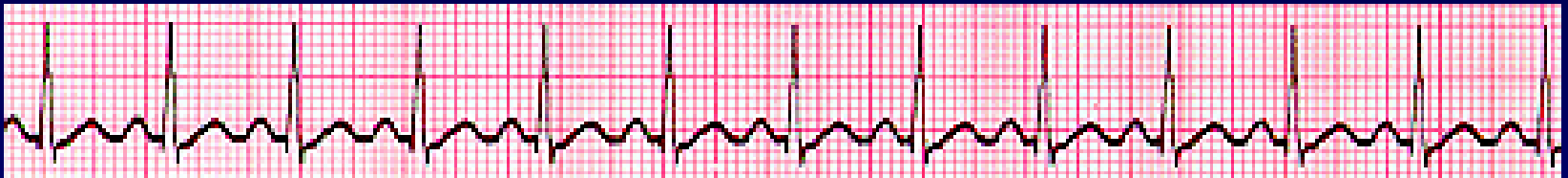
- Deviation from NSR
 - Rate < 60 bpm

Sinus Bradycardia



- **Etiology:** SA node is depolarizing slower than normal, impulse is conducted normally (i.e. normal PR and QRS interval).

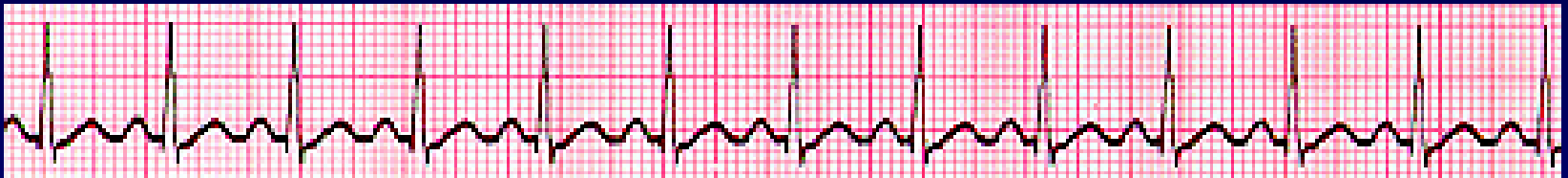
Rhythm #2



- Rate? 130 bpm
- Regularity? regular
- P waves? normal
- PR interval? 0.16 s
- QRS duration? 0.08 s

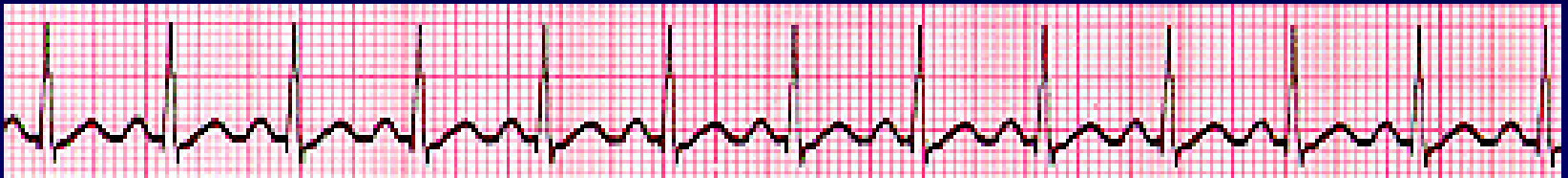
Interpretation? *Sinus Tachycardia*

Sinus Tachycardia



- Deviation from NSR
 - Rate > 100 bpm

Sinus Tachycardia



- **Etiology:** SA node is depolarizing faster than normal, impulse is conducted normally.
- Remember: sinus tachycardia is a response to physical or psychological stress, not a primary arrhythmia.

Premature Beats

- *Premature Atrial Contractions*
(PACs)
- *Premature Ventricular Contractions*
(PVCs)

Rhythm #3



- Rate? 70 bpm
- Regularity? occasionally irreg.
- P waves? 2/7 different contour
- PR interval? 0.14 s (except 2/7)
- QRS duration? 0.08 s

Interpretation? *NSR with Premature Atrial Contractions*

Premature Atrial Contractions



- Deviation from NSR
 - These ectopic beats originate in the atria (but not in the SA node), therefore the contour of the P wave, the PR interval, and the timing are different than a normally generated pulse from the SA node.

Premature Atrial Contractions



- **Etiology:** Excitation of an atrial cell forms an impulse that is then conducted normally through the AV node and ventricles.

Teaching Moment

- When an impulse originates anywhere in the atria (SA node, atrial cells, AV node, Bundle of His) and then is conducted normally through the ventricles, the QRS will be narrow (0.04 - 0.12 s).



Premature Beats

- *Premature Ventricular Contractions (PVCs)*

Rhythm #4



- Rate? 60 bpm
- Regularity? occasionally irreg.
- P waves? none for 7th QRS
- PR interval? 0.14 s
- QRS duration? 0.08 s (7th wide)

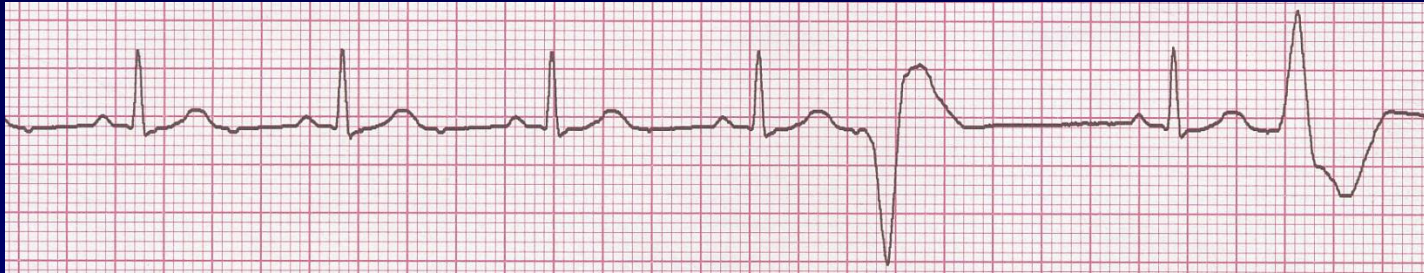
Interpretation? *Sinus Rhythm with 1 PVC*

PVCs



- Deviation from NSR
 - Ectopic beats originate in the ventricles resulting in wide and bizarre QRS complexes.
 - When there are more than 1 premature beats and look alike, they are called “uniform”. When they look different, they are called “multiform”.

PVCs



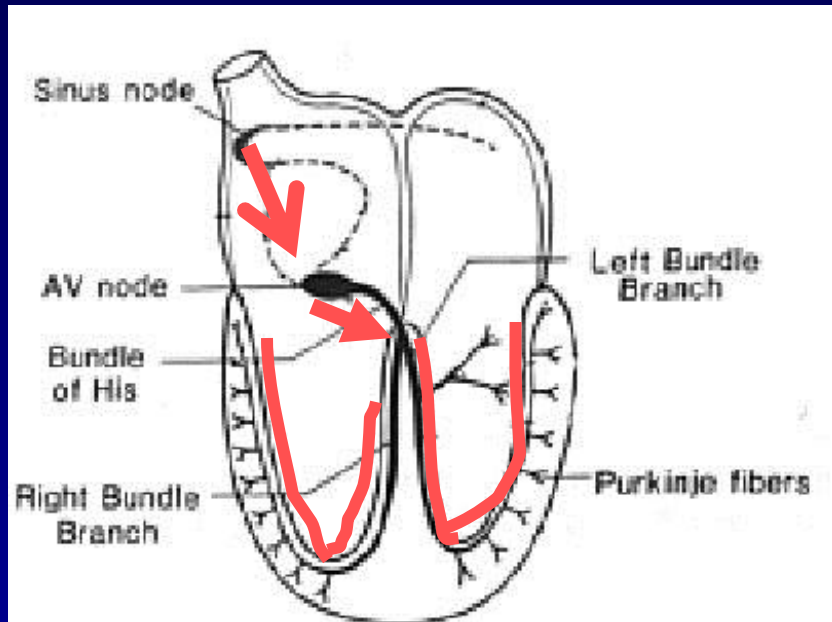
- **Etiology:** One or more ventricular cells are depolarizing and the impulses are abnormally conducting through the ventricles.

Teaching Moment

- When an impulse originates in a ventricle, conduction through the ventricles will be inefficient and the QRS will be wide and bizarre.

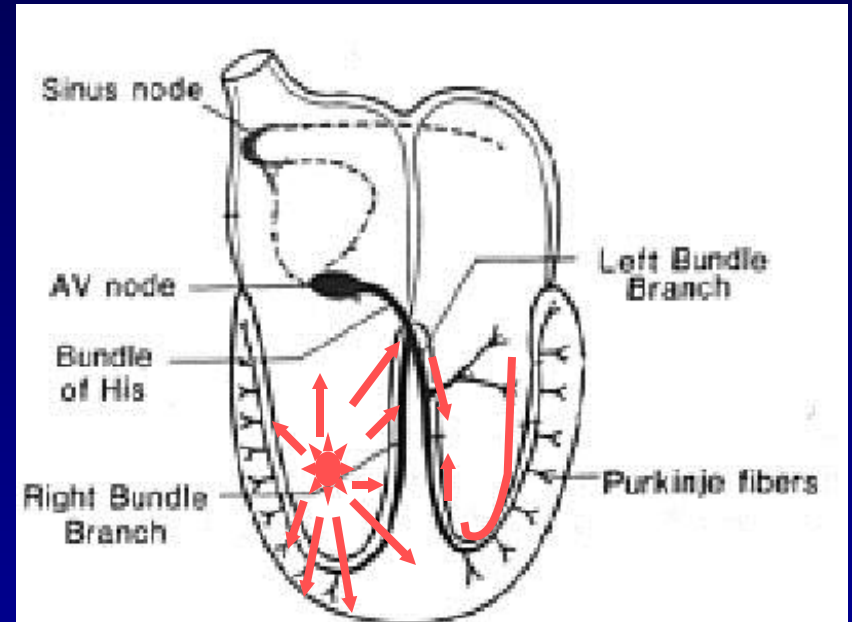


Ventricular Conduction



Normal

Signal moves rapidly through the ventricles



Abnormal

Signal moves slowly through the ventricles

Supraventricular Arrhythmias

- *Atrial Fibrillation*
- *Atrial Flutter*
- *Paroxysmal Supraventricular Tachycardia*

Rhythm #5



- Rate? 100 bpm
- Regularity? irregularly irregular
- P waves? none
- PR interval? none
- QRS duration? 0.06 s

Interpretation? *Atrial Fibrillation*

Atrial Fibrillation



- Deviation from NSR
 - No organized atrial depolarization, so no normal P waves (impulses are not originating from the sinus node).
 - Atrial activity is chaotic (resulting in an irregularly irregular rate).
 - Common, affects 2-4%, up to 5-10% if > 80 years old

Atrial Fibrillation



- **Etiology:** Recent theories suggest that it is due to multiple re-entrant wavelets conducted between the R & L atria. Either way, impulses are formed in a totally unpredictable fashion. The AV node allows some of the impulses to pass through at variable intervals (so rhythm is irregularly irregular).

Rhythm #6



- Rate? 70 bpm
- Regularity? regular
- P waves? flutter waves
- PR interval? none
- QRS duration? 0.06 s

Interpretation? *Atrial Flutter*

Atrial Flutter



- Deviation from NSR
 - No P waves. Instead flutter waves (note “sawtooth” pattern) are formed at a rate of 250 - 350 bpm.
 - Only some impulses conduct through the AV node (usually every other impulse).

Atrial Flutter



- **Etiology:** Reentrant pathway in the right atrium with every 2nd, 3rd or 4th impulse generating a QRS (others are blocked in the AV node as the node repolarizes).

Rhythm #7



- Rate? 74 → 148 bpm
 - Regularity? Regular → regular
 - P waves? Normal → none
 - PR interval? 0.16 s → none
 - QRS duration? 0.08 s
- Interpretation? *Paroxysmal Supraventricular Tachycardia (PSVT)*

PSVT



- Deviation from NSR
 - The heart rate suddenly speeds up, often triggered by a PAC (not seen here) and the P waves are lost.

PSVT



- **Etiology:** There are several types of PSVT but all originate above the ventricles (therefore the QRS is narrow).
- Most common: abnormal conduction in the AV node (reentrant circuit looping in the AV node).

Ventricular Arrhythmias

- *Ventricular Tachycardia*
- *Ventricular Fibrillation*

Rhythm #8



- Rate? 160 bpm
- Regularity? regular
- P waves? none
- PR interval? none
- QRS duration? wide (> 0.12 sec)

Interpretation? *Ventricular Tachycardia*

Ventricular Tachycardia



- Deviation from NSR
 - Impulse is originating in the ventricles (no P waves, wide QRS).

Ventricular Tachycardia



- **Etiology:** There is a re-entrant pathway looping in a ventricle (most common cause).
- Ventricular tachycardia can sometimes generate enough cardiac output to produce a pulse; at other times no pulse can be felt.

Rhythm #9



- Rate? none
- Regularity? irregularly irreg.
- P waves? none
- PR interval? none
- QRS duration? wide, if recognizable

Interpretation? *Ventricular Fibrillation*

Ventricular Fibrillation



- Deviation from NSR
 - Completely abnormal.

Ventricular Fibrillation



- **Etiology:** The ventricular cells are excitable and depolarizing randomly.
- Rapid drop in cardiac output and death occurs if not quickly reversed