Medical Education Angels

Basic Arrhythmia Course Objectives

By the end of the course students will be able to:

- Identify all components of the cardiac electrical system and correlate this to what is happening on the EKG tracing.
- Label and measure all components of the EKG tracing.
- Place the electrodes for a 3 and 5 lead cardiac monitoring system.
- Understand the importance of correct lead placement.
- Accurately measure PRI, QRS and QTI.
- Identify the following rhythms with at least 90% accuracy:
- Sinus Rhythm
- Sinus Bradycardia
- Sinus Tachycardia
- Sinus Arrhythmia
- SB/SR with first degree heart block
- Atrial Fibrillation
- Atrial Flutter
- Junctional rhythms
- Ventricular Tachycardia
- Ventricular Fibrillation
- Idioventricular
- Pace rhythms and identify pacemaker malfunction
- 2nd Degree Type 1 and 2 Heart Blocks
- 3rd Degree Complete Heart Block
- Changes associated with MI
- Asystole vs leads off
- Artifact
- Ectopy: PAC/PJC/PVC
- Briefly covered but content not specifically tested and no clear learning objective: bundle branch blocks, 12 lead EKG, PEA, and electrolytes changes and the impact that can have on the cardiac tracing.

Students must attend all sessions in order and agree to studying to reinforce key concepts to be successful.

Course Agenda

Medical Education Angels basic arrhythmia course is a comprehensive beginning course. Because of the large amount of new vocabulary, many students have some trouble fully conceptualizing the material the first time they hear it. For your greatest success, there is a need for you to study at home to reinforce the material we cover each week. The agenda is a rough outline.

Prior to class (optional but strongly encouraged)

- Print out vocabulary list and make into flashcards
- There's a phenomenal amount of data and free material you can view on-line. It can be overwhelming. If you google: "An ECG Primer" there is a nice free downloadable chapter outlining Basic Dysrhythmia interpretation or McGraw-Hill has a good free download too: "ECG Interpretation and Clinical Significance."
- Unless we provided some, you should purchase blank index cards to make flashcards. In classes where we have provided completed flash cards, the level of cognition is lower. *Writing them out helps* to reinforce the concepts and defining criteria of each rhythm.
- **Purchasing a set of medical or EKG calipers will help you with measuring strips.** They are less than $15 and can be found in uniform shops, online, and places that sell medical products.
- As silly as this sounds, practice your 4's times tables. The EKG graph is measure in .04 increments. Reviewing 1x.04= .04 2x.04 = .08 3x.04=.12 4x.04=.16 5x.04=.20 6x.04=.24 7x.04=.28 8x.04=.32 9x.04=.36 10x.04=.40 That's about the hardest math we have in this class, but review helps!

Meeting 1

- Basics of the electrical system
- Lead Placement and artifact
- Labeling the EKG
- Measuring the EKG strip
- Review of Asystole, Sinus, Sinus Bradycardia, Sinus Tachycardia, Sinus Arrhythmia, SVT, First Degree Heart Block, Explain PEA.

Meeting 2

- Review previous week, answer questions, correct strips sent home as homework
- Atrial Fibrillation, Atrial Flutter, Junctional Rhythms, Ventricular tachycardia, Ventricular Fibrillation, ectopy

Meeting 3

- Review previous week, answer questions, correct strips sent home as homework
- All remaining heart blocks, paced rhythms, and pacer maker issues
- Changes associated with MI, Electrolyte levels

Meeting 4

- Review previous week, answer questions, correct strips sent home as homework
- Final Exam

On some occasions: the 4th meeting is used for review and practice. In these instances, the final exam is scheduled with the participants individually.

We remember how confusing this can be and encourage questions. You can text us (at any reasonable hour ☺) with a question. Unfortunately, if you miss a session, we cannot provide a one on one make up session. We encourage you to get notes or recordings from someone else in class. We also do not give refunds for missed sessions. Our goal is that every student be confident in their abilities and can learn in a relaxed and fun atmosphere. We will remediate with you if needed free of charge, you are always welcomed to audit our courses for free for up to 2 years and are happy to make payment arrangements if needed. Our last request is that you respect the hours we have put into developing this course and not post or hand out copies of our material. We are more than happy to share, but please have people contact us directly.

Vocabulary & Glossary

Electrocardiogram: a simple, non-invasive, procedure where electrodes are placed in specific location on the body. The electrodes detect the tiny electrical charges on the skin that arise from the heart muscle depolarizing and repolarizing. The lines, segments, and waves produced show the different stages of the cardiac cycle as well as providing information on the health of the heart muscle and electrolyte status. We assume that if there is electrical activity that mechanical activity follows. The study can be abbreviated ECG or EKG.

Sinoatrial node (SA node): this node is a group of specialized cells that spontaneously generates electrical impulses. It is sometime referred to the as the natural pacemaker of the heart. It normally generates electrical impulses 60-100 times per minute. The electrical impulse travels from the SA node to the AV node via electrical pathways.

Atrioventricular Node (AV node): the area of specialized tissue between the atria and ventricles of the heart. The signal that has traveled from the SA node, excites the AV node. The AV node delays the impulse briefly. This gives the atria time to completely empty the blood into the ventricles and helps to protect the ventricles from atrial tachycardias. The AV node has an intrinsic firing rate is 40-60 bpm.

Bundle of HIS: the AV Node tapers down into the bundle of HIS as it moves into the ventricles. It divides into the right and left bundle branches to carry the electrical impulses to each side of the heart. The intrinsic firing rate of the Bundle of HIS is 20bpm or less.

Bundle Branches: the Bundle of HIS separates into the right and left bundle branches. The left bundle divides one more time which allows the electrical impulse to spread efficiently across the larger, left ventricle.

Purkinje Fibers: these thin filaments pick up the electrical impulse from the bundle branches and deliver it to the ventricular muscle.

Isoelectric Line: the base line of the electrocardiogram (ECG)

P wave: a deflection in the ECG representing atrial depolarization. A normal P wave is small, round, upright in lead II. In a normal EKG the P way will be unifocal in appearance, and there will be one P wave preceding each QRS complex.

PR Interval (PRI): the length of time from the beginning of the P wave to the beginning of the QRS complex. Normal is 0.12-.20 seconds. This is representing the time it took the impulse to travel from the SA node to the AV node.

QRS Complex: a group of waves on the ECG that is actually made up of 3 separate waves and represents the passage of the electrical impulse through the ventricles. In a normal ECG, the Q wave may be present or is small, large Q waves are an indication of previous myocardial injury. The Q wave is the negative deflection before the first R wave, an R wave is any positive deflection and the S wave is the negative deflection after the R wave. Normal QRS complexes measure <0.10-0.12 seconds. Longer measurements may indicate a blockage in one of the bundle branches.

ST Segment: Connects the QRS complex and the T wave. The beginning of the ST segment is called the J point which stands for 'junction between QRS complex and ST segment.' In general, ST segments may slightly curve upright into the T wave. Down sloping or depressed ST segments may indicate coronary ischemia, hypokalemia, dig toxicity, etc. whereas ST elevation >1mm or 1 box on the ECG tracing points to myocardial injury. Generally the taller the ST segment, the more we suspect MI.

T wave: tall, rounded, and upright in most leads, the T is the electrical representation of the ventricles repolarizing or recovering. Mechanically, this is representing the heart in diastole. Inverted T waves can be a sign of coronary ischemia, left ventricular hypertrophy, etc. T waves can also be affected by electrolyte levels such as potassium. High K+ can result in peaked, tall T waves whereas low K+ may show up as flatter T waves.

QT Interval (QTI): this is measured from the beginning of the QRS complex to the end of the T wave. This represents the electrical activity for one complete ventricular cycle. General normal measurements are 0.30-0.40 seconds.

U wave: generally not present, U waves follow the T wave and appear as a small, rounded, upright bump on the ECG. They can be normal in young, athletic individuals, are most prominent in low K+, high Ca++, treatment with digitalis or epinephrine. Like the T wave, inverted U waves may indicate cardiac ischemia. It is thought that the U wave is repolarization of the papillary muscle or purkinje fibers.

J point: the point where the QRS meets the ST segment. It is generally easy to identify since the it forms a sharp angle with the last part of the QRS complex and is the return to the isoelectric line. The J point raises or lowers off the isoelectric line with cardiac ischemia and injury.

Artifact: generally caused by the patient's movement, jiggling of the EKG wires and more common if the electrodes are dried in the center or not making a good connection with the skin. Artifact can mimic some dysrhythmias or appears a sharp, jagged lines.

Regular VS Irregular: when interpreting and measure ECG's one of the first steps is deciding if the interval of time (number of boxes on the tracing) is same within 1 box from P wave to P wave (shows atrial regularity) and from QRS complex to QRS complex (shows ventricular regularity).

Ectopy: an extra beat that usually arises by a group of cells or fibers outside the usual conduction pathway. A certain number of ectopic beats are considered normal (generally of no concern if less than 10 % of your cardiac rhythm or <10 ectopic beats per minute, none in a row). Ectopy can be triggered by stimulants, food, medication, stress, etc. Common triggers are smoking, caffeine, alcohol, chocolate, anxiety, etc. Ectopy can be further classified by its origin: premature atrial contraction (PAC), premature junctional contraction (PJC), or premature ventricular contraction (PVC). Ectopic beats become of more concern

when they are more frequent or sequential. 2 ectopic beats in a row is a pair or couplet, 3 or more is considered a run. If you have a large amount of ectopy: think hypoxia or electrolyte imbalance.

Unifocal: the term is most frequently used when describing a dysrhythmia or frequent ectopic beats. Unifocal means originating from 1 foci or 1 irritable spot. You can tell easily because each beat looks the same.

Multifocal: this term is most frequently used when describing a dysrhythmia or frequent ectopic beats. Multifocal means originating from 2 or more foci or irritable spots. You can tell easily because each wave or beat looks different.

Bigeminy: this term is used to describe ectopy that is occurring every other beat. Ex: bigeminal PAC's. Trigeminy: this term is used to describe ectopy that is occurring every third beat. Ex: trigeminal PVC's.

Monomorphic: like unifocal- each beat looks the same, we say the morphology or shape of the beats are monomorphic.

Polymorphic: like multifocal – beats appear different, we say they have different shape or morphology and polymorphic.

Video Review of all content https://youtu.be/FbwWam4sid8

Reference Pages and Examples

Normal Sinus Rhythm (1 upright P for every QRS)

Rate: regular 60-100bpm PRI .12-.20 QRS: <.12

Sinus Bradycardia (1 upright P for every QRS)

Rate: regular and <60bpm PRI .12-.20 QRS: <.12

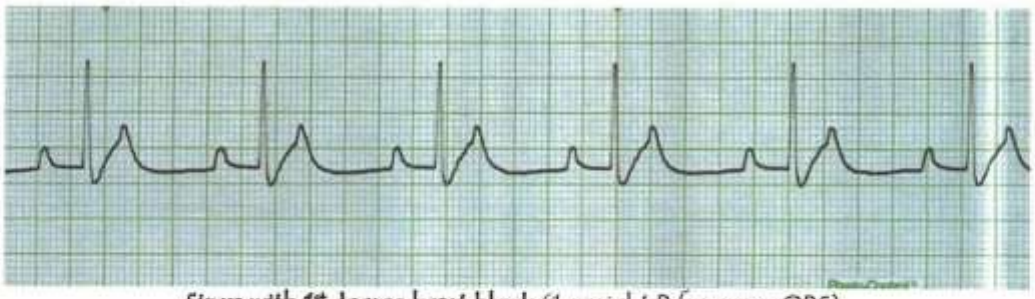
Sinus Tachycardia (1 upright P for every QRS)

Rate: regular and >100bpm PRI .12-.20 QRS: <.12

Sinus Arrhythmia (1 upright P for every QRS)

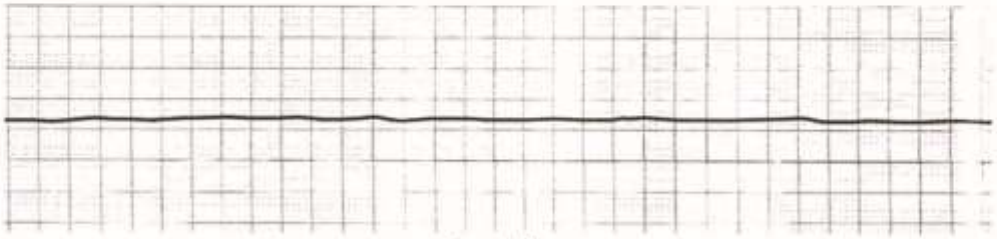
Rate: GENTLY irregular, gradual rate changes often with respirations, generally 60-100bpm

PRI .12-.20 QRS: <.12



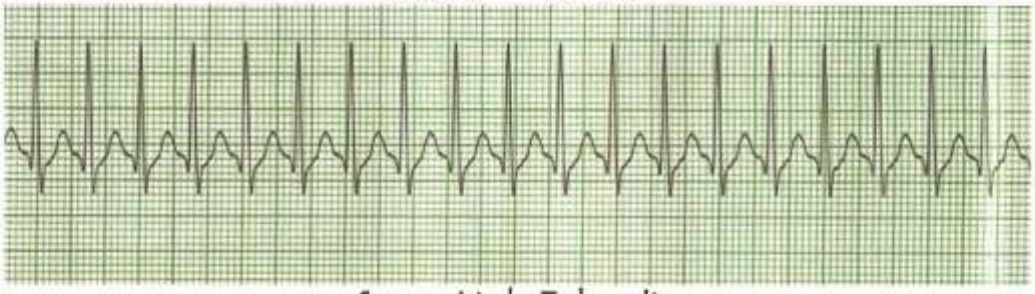
Sinus with 1st degree heart block (1 upright P for every QRS)

Rate: can be bradycardia or normal 60-100bpm PRI:>.20 QRS: <.12



Asystole

PRI: n/a QRS: n/a



Supraventricular Tachycardia

Regular, rate >150bpm P's and T's get squished together PRI: n/a QRS: <.12

Atrial Fibrillation

IRREGULARLY- IRREGULAR! No P waves, wavy/bumpy baseline PRI: n/a QRS: <.12

Atrial Flutter

Flutter waves look saw-toothed instead of typical P waves, usually regular, but not always

Atrial rate usually > ventricular rate PRI: n/a QRS: <.12

Junctional Rhythm

Rate: regular and 40-60bpm P waves inverted/absent/retrograde

PRI if measurable often short QRS: <.12

Accelerated Junctional Rhythm

Rate: regular and 60-100bpm P waves inverted/absent/retrograde

PRI if measurable often short QRS: <.12

Junctional Tachycardia

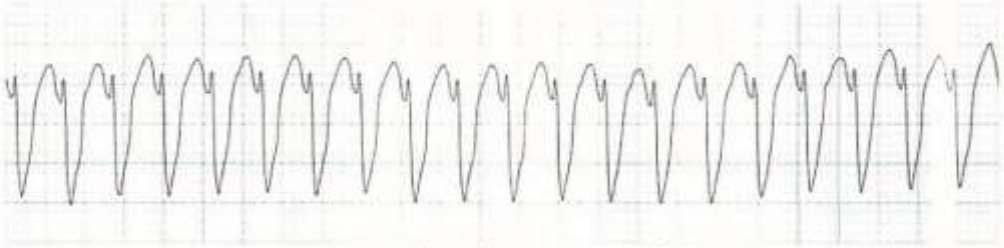
Rate: regular and >100bpm P waves inverted/absent/retrograde

PRI if measurable often short QRS: <.12

Idioventricular

Rate: regular and slow 20-40bpm PRI n/a QRS: >.12 wide and bizarre

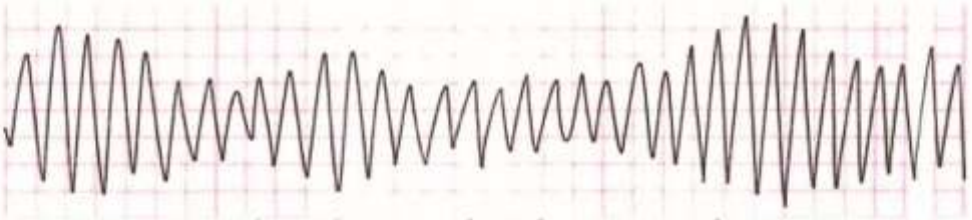
If the rate is >40, we simply call it accelerated idioventricular



Ventricular Tachycardia (V-Tach)

also called Monomorphic V-Tach

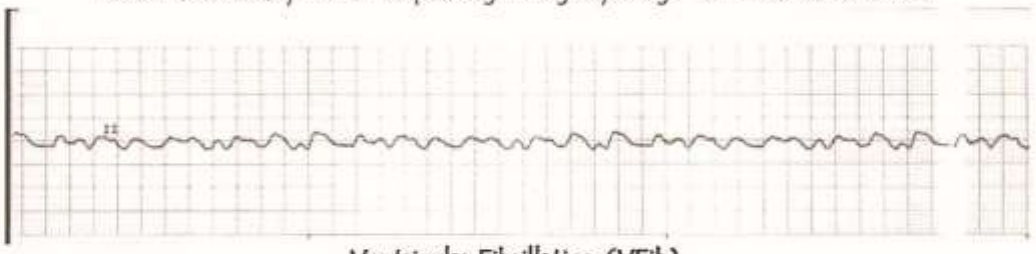
Vent Rate: usually 110-250bpm, reg or slightly irreg. no P wave PRI n/a QRS: >.12



Polymorphic Ventricular Tachycardia (V-Tach)

also called Torsades or Torsades de Pointe

Vent Rate: usually 110-250bpm, reg or slightly irreg. no P waves. QRS: >.12



Ventricular Fibrillation (VFib)

Rate: irregular/chaotic heart is in spasm PRI n/a QRS n/a

This rhythm is always pulseless

Ventricular Fibrillation (VFib) course

Rate: irregular/chaotic pulseless the heart is in spasm PRI n/a QRS n/a

2nd degree heart block, type 1

Also called: Wenckebach and 2nd degree, Mobitz 1

Irregular because the PRI: elongates until there is a P wave without a ventricular response

Usually bradycardic to normal rate QRS: <.12

2nd degree heart block, type 2

Also called 2nd degree, Mobitz 2

Can be reg/irreg as there are extra more P's that QRS's complexes, usually bradycardic

PRI for conducting P waves are the same each complex .12-.20 QRS: <.12

3rd degree heart block

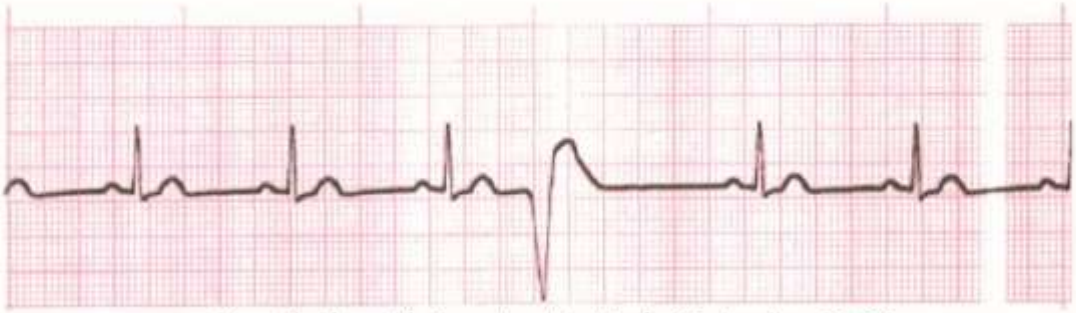
Also called Complete Heart Block, Complete AV Block, AV Dissociation

Reg atrial rate, reg ventricular rate, but atrial rate > than ventricular

PRI: variable QRS: can be normal or wide, ventricular response usually slow

Sinus Rhythm with Premature Atrial Contractions (PAC's)

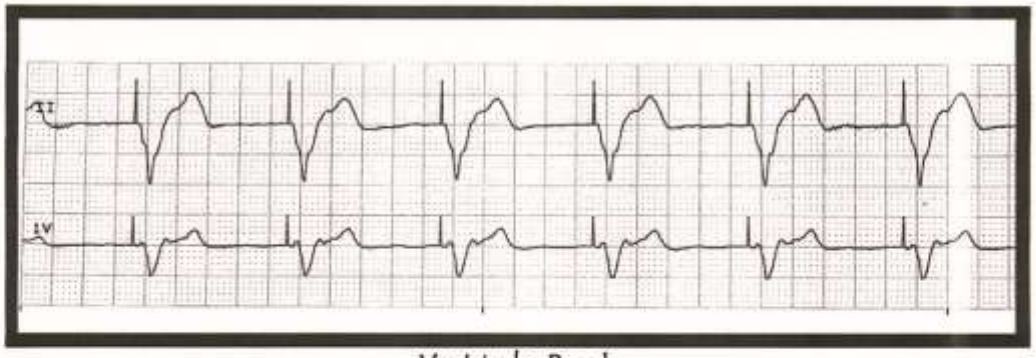
Sinus Rhythm with Premature Junctional Contraction (PJC)



Sinus Rhythm with Premature Ventricular Contraction (PVC)

Sinus Rhythm with PVC's

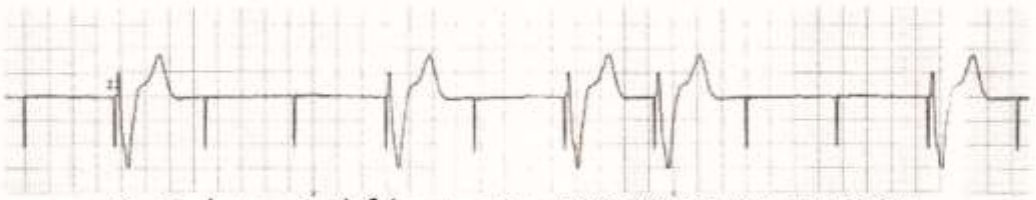
These PVC's are multifocal: because they look different, we know they come from different areas in the heart.



Ventricular Paced

Atrial and Ventricular Paced with a PVC

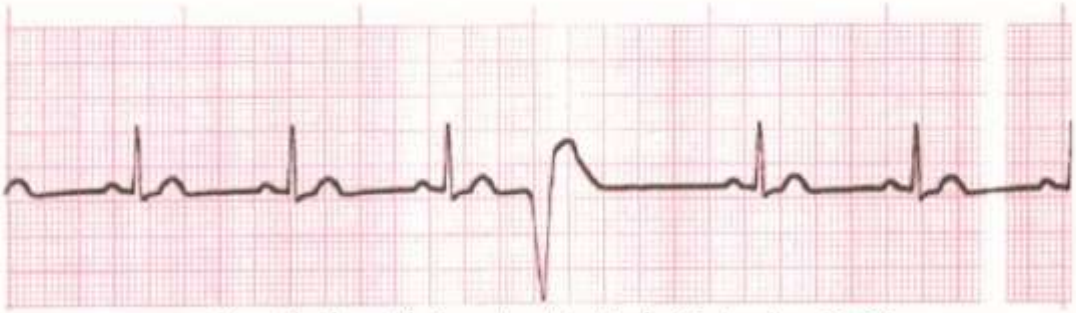
Some v-paced, mostly a-v paced and 3 PVC's



Ventricular paced with failure to capture: PACEMAKER MALFUNCTION

Sinus Rhythm with Premature Atrial Contractions (PAC's)

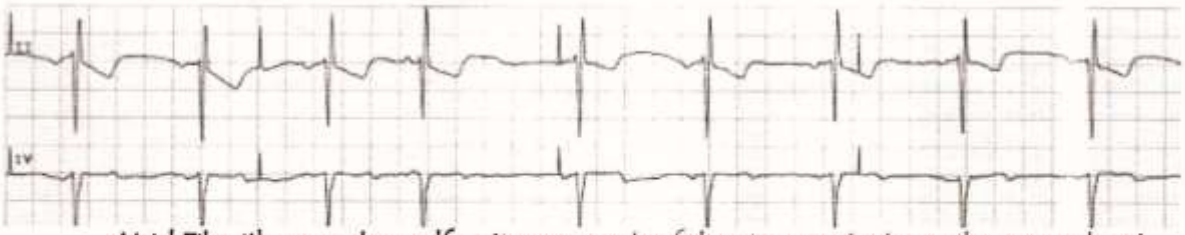
Sinus Rhythm with Premature Junctional Contraction (PJC)



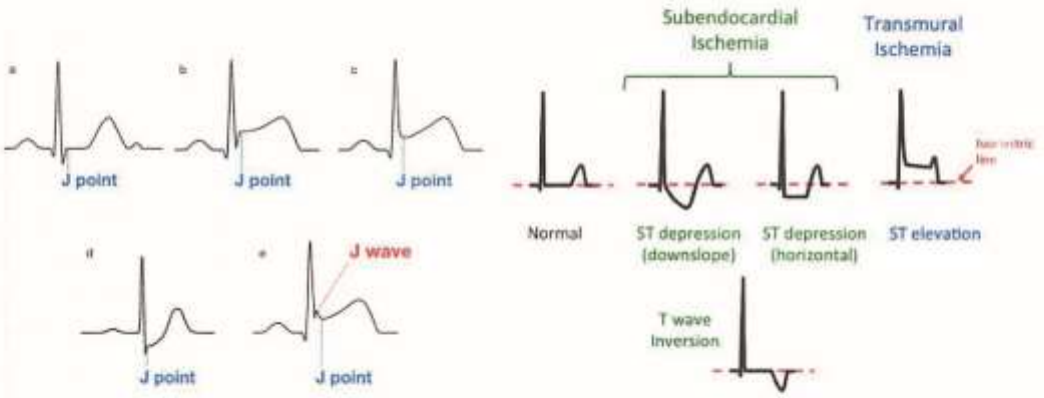
Sinus Rhythm with Premature Ventricular Contraction (PVC)

Sinus Rhythm with PVC's

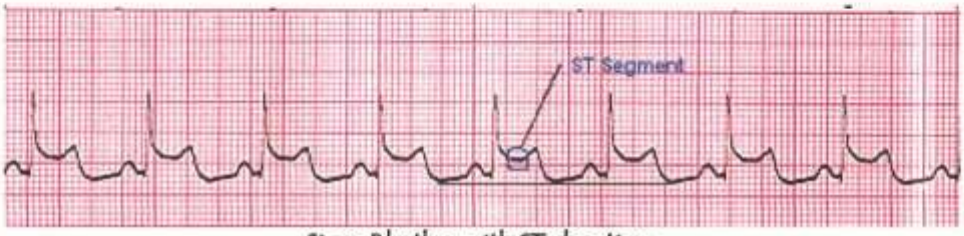
These PVC's are multifocal: because they look different, we know they come from different areas in the heart.



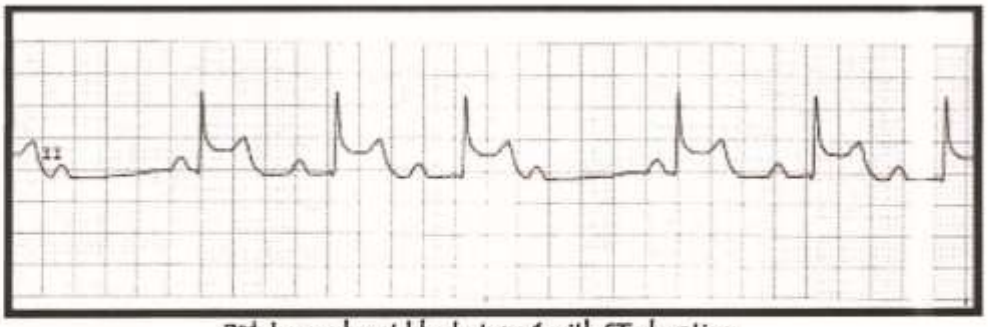
Atrial Fib with pacemaker malfunction: pacemaker failing to sense (spikes in the wrong places)



The beginning of the ST segment is called the J point. When the J point moves either above or below the baseline, it can indicate ischemia or injury.



Sinus Rhythm with ST elevation



2nd degree heart block, type 1 with ST elevation