

Before we talk about lethal rhythms, we have to be honest with ourselves for a moment. I can't teach someone how to color if they don't know how to hold the crayon. Block 4 telemetry assumes that you already understand the foundational ECG concepts you learned in Block 2. That includes PQRST analysis, understanding segments and intervals, calculating heart rate, and correctly identifying sinus rhythm, sinus bradycardia, sinus tachycardia, atrial flutter, and stable atrial fibrillation.

Block 4 also does not introduce dozens of new rhythms. In fact, according to the MaricopaNursing curriculum, only a small number of new rhythms are introduced here. The reason they matter so much is that they are high-risk, highly test-plan relevant, and very capable of ending a life quickly if they are missed or misinterpreted.

Let's begin with ECG monitoring systems and lead selection. There are three-lead, four-lead, and five-lead ECG monitoring systems. The number of leads used determines how many angles of the heart you can monitor. A five-lead system provides up to seven selectable lead views and is the only system that allows monitoring of the anterior wall of the left ventricle.

The two ECG leads most commonly selected for continuous monitoring are Lead II and V1. Lead II is especially important because it best displays atrial activity and rhythm regularity. That is why many rhythm strips, including the ones used in this lecture, are shown in Lead II.

Now let's review electrode placement, because theory really does matter here. You may remember the memory aid: *white on right, smoke over fire, don't poop in the grass*. In theory, limb leads are placed on the extremities. White goes on the right arm, corresponding to aVR. Black goes on the left arm for aVL. Red goes on the left leg for aVF. Green goes on the right leg. These electrodes communicate with one another to form Leads I, II, and III.

The precordial leads create the remaining six views of the heart. These are V1 through V6, placed at specific intercostal spaces and anatomical landmarks across the chest. Together, the limb leads and precordial leads produce a true 12-lead ECG.

In real clinical practice, nurses often place limb leads on the torso instead of the extremities. This occurs for many reasons, including patient movement, short wires, blood pressure cuffs, IV lines, missing extremities, and sometimes simple convenience. However, for diagnostic accuracy—especially when ischemia is suspected—a properly placed 12-lead ECG is essential. One of the most concerning

issues in practice is clinicians placing leads based on habit rather than knowledge. That is something PVCC students are expected to rise above.

Now let's review what the ECG waveform actually represents. ECG paper measures time on the horizontal axis and voltage on the vertical axis. When the waveform moves upward, that is called a positive deflection. When it moves downward, it is a negative deflection.

The P wave represents atrial depolarization, meaning the electrical impulse is starting in the SA node and spreading through the atria. The QRS complex represents ventricular depolarization and is normally less than 0.12 seconds in duration. The T wave represents ventricular repolarization. The PR interval is measured from the beginning of the P wave to the beginning of the QRS complex and normally ranges from 0.12 to 0.20 seconds. The ST segment is evaluated for elevation or depression, which may indicate ischemia. The QT interval can be prolonged by many medications and places the patient at risk for torsades de pointes. The U wave is rare, but when present, it is often associated with hypokalemia, hypertension, or heart disease.

Let's talk about heart rate calculation and do a quick reality check. A one-minute rhythm strip contains 300 large boxes and 1500 small boxes. You can calculate heart rate by dividing 1500 by the number of small boxes between R waves. Or, you can do what most nurses actually do in real practice: use a six-second strip, count the number of beats, and multiply by ten—as long as the rhythm is regular.

But here is the most important point: the patient's pulse is always more accurate than the monitor. Electrical activity without a pulse has a name, and we will come back to that shortly.

Now let's briefly review sinus rhythms, which is Block 2 knowledge you absolutely must carry forward. A sinus rhythm originates in the SA node, has a P wave before every QRS complex, and has a rate between 60 and 100 beats per minute in adults.

Sinus bradycardia has the same overall appearance but a rate less than 60 beats per minute. Causes include sleep, athletic conditioning, hypothyroidism, vagal stimulation, medications such as beta blockers and calcium channel blockers, increased intracranial pressure, and inferior wall myocardial infarction. Symptomatic and unstable bradycardia is frequently related to hypoxemia.

Sinus tachycardia has a P wave and a rate greater than 100 beats per minute, usually less than 120. Causes include stress, pain, fever, hypovolemia, anemia, shock, stimulants, and certain medications. Special considerations include inappropriate

sinus tachycardia and postural orthostatic tachycardia syndrome, or POTS, which presents as tachycardia without hypotension when the patient changes position.

Now let's briefly review atrial dysrhythmias. Atrial flutter is regular, with atrial rates between 250 and 400 beats per minute and a characteristic sawtooth F wave. Atrial fibrillation is irregular, lacks distinct P waves, and may present with rapid ventricular response. When atrial fibrillation is accompanied by RVR, patients often become unstable. When using the CRISP reference, if you are asked whether a P wave is identifiable, the correct answer is no.

Now we move into the **new Block 4 rhythms**. Per curriculum, these are the only new rhythms introduced in Block 4, and all are NCLEX-relevant.

Premature ventricular contractions, or PVCs, are impulses that originate in the ventricle before the next sinus beat. The QRS is wide—greater than or equal to 0.12 seconds—and bizarre in appearance. Patterns include bigeminy, where every other beat is a PVC, and trigeminy, where every third beat is a PVC. PVCs may occur in healthy individuals but are also associated with ischemia, infarction, heart failure, tachycardia, digitalis toxicity, hypoxia, acidosis, and electrolyte imbalances, especially hypokalemia.

Ventricular tachycardia is defined as three or more PVCs in a row at a rate greater than 100 beats per minute. Monomorphic ventricular tachycardia has a regular rhythm with consistent QRS morphology. Polymorphic ventricular tachycardia has varying QRS morphology and includes torsades de pointes. This rhythm is life-threatening and may or may not produce a pulse.

Supraventricular tachycardia, specifically AV nodal reentrant tachycardia, occurs when an impulse repeatedly circles through the AV node, producing rates between 120 and 200 beats per minute. P waves are often indistinguishable from T waves. If you are unsure, say “no” in step two of CRISP. Triggers include caffeine, nicotine, hypoxemia, stress, coronary artery disease, and cardiomyopathy. It occurs more commonly in females and often without structural heart disease.

Ventricular fibrillation is the most common rhythm seen in cardiac arrest. It is chaotic, disorganized, and produces no effective contraction—therefore, no pulse. If a patient has a pulse, they are not in ventricular fibrillation. Ever.

Asystole is the absence of ventricular activity, confirmed in two leads. There is no pulse, no respiration, and no cardiac output. Asystole cannot be defibrillated because

there is no electrical activity to reset. Movie scenes aside, the only reason to check another lead is to ensure you are not missing fine ventricular fibrillation.

Pulseless electrical activity, or PEA, occurs when electrical activity appears on the monitor, but the heart does not contract effectively. The rhythm may look like sinus rhythm, but the patient has no pulse and is in cardiac arrest. Common causes include hypovolemia, myocardial infarction, massive pulmonary embolism, hyperkalemia, hypothermia, severe hypoxia, and drug overdose. If there is no pulse, CPR is required regardless of what the monitor shows.

To close, this marks the end of telemetry content for Block 4. Heart blocks, idioventricular rhythms, and advanced 12-lead interpretation are beyond the scope of this course. If students want more, ACLS and advanced ECG courses exist.

And finally, remember one of my favorite F-words: free. You thought I was gonna say something else didn't you? SkillStat dot com provides free rhythm practice, and practice is how confidence is built.

BLOCK 4 – TELEMETRY STUDY GUIDE

Why Telemetry Matters in Block 4

- Block 4 telemetry builds directly on Block 2 ECG foundations
- You are expected to already know:
 - PQRST analysis
 - Segments and intervals
 - Heart-rate calculation
 - Sinus rhythm
 - Sinus bradycardia
 - Sinus tachycardia
 - Atrial flutter
 - Stable atrial fibrillation
- The rhythms you do learn are:
 - High risk

- [NCLEX test-plan relevant](#)
 - Potentially fatal if missed
-

ECG Monitoring Systems & Lead Selection

- ECG systems may be:
 - 3-lead
 - 4-lead
 - 5-lead
- **More leads = more views of the heart**
- A 5-lead system:
 - Provides up to 7 selectable lead views
 - Is the only system that monitors the anterior wall of the left ventricle
- Most commonly selected leads for continuous monitoring:
 - Lead II
 - V1
- Lead II is preferred because:
 - Best visualizes atrial activity
 - Best shows rhythm regularity
 - Most rhythm strips are displayed in Lead II

Check out [this](#) video explanation

Electrode Placement – Theory Still Matters

Memory Aid: *White on right, smoke over fire, don't poop in the grass*

Limb Leads (Theory Placement)

-  **White** → Right arm → aVR
-  **Black** → Left arm → aVL
-  **Red** → Left leg → aVF
-  **Green** → Right leg
- These create Leads I, II, and III

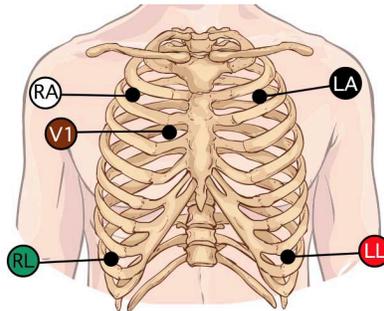
Precordial (Chest) Leads

-  **Brown V1**
- V2-V6
- Placed at specific intercostal spaces and landmarks
- Limb + precordial leads = true 12-lead ECG

Real-World Practice

- Limb leads often placed on torso due to:
 - Patient movement
 - Short wires
 - BP cuffs
 - IV lines
 - Missing extremities
 - Staff laziness
-  **For diagnostic accuracy, especially ischemia:**
 - **Proper 12-lead placement is essential**
- PVCC expectation:
 - Knowledge-based placement, not habit-based placement

Check out [this](#) video explanation

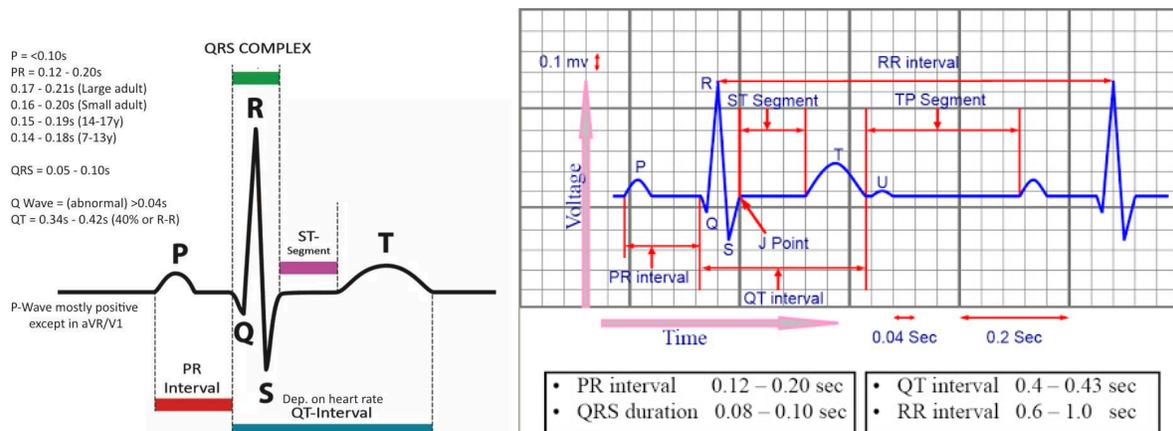


Understanding the ECG Waveform

- Horizontal axis = time
- Vertical axis = voltage
- Upward movement = positive deflection
- Downward movement = negative deflection

Waveform Components

- P wave → Atrial depolarization (SA node firing)
- **QRS complex** → Ventricular depolarization
 - **Normal: < 0.12 seconds**
- T wave → Ventricular repolarization
- **PR interval** →
 - **Normal: 0.12–0.20 seconds**
- ST segment → Evaluate for elevation/depression (ischemia)
- QT interval → Prolonged by many meds → risk for torsades
- U wave (rare):
 - Seen with hypokalemia
 - Hypertension
 - Heart disease



🕒 Heart-Rate Calculation (Reality Check)

- 1-minute strip:
 - 300 large boxes
 - 1500 small boxes
- Methods:
 - 1500 ÷ small boxes between R waves
 - **6-second strip × 10 (regular rhythms only)**
- **★ Most important rule:**
 - The patient's pulse is always more accurate than the monitor
 - Electrical activity without a pulse has a name (PEA)

Refer to the [CRISP REFERENCE](#)

♥ Sinus Rhythms (Block 2 Knowledge You MUST Bring Forward)

Sinus Rhythm

- Originates in SA node
- P wave before every QRS
- Rate: 60–100 bpm

Sinus Bradycardia

- Rate: < 60 bpm (< 50 is concerning per the AHA Bradycardia algorithm)
- Causes:
 - Sleep
 - Athletic conditioning
 - Hypothyroidism
 - Vagal stimulation
 - Beta blockers
 - Calcium channel blockers
 - Increased ICP
 - Inferior wall MI
- ⚠ Symptomatic bradycardia often related to hypoxemia



Sinus Tachycardia

- Rate: > 100 bpm, usually < 120
- Causes:
 - Stress
 - Pain
 - Fever
 - Hypovolemia
 - Anemia
 - Shock
 - Stimulants
 - Certain medications
- Special considerations:
 - Inappropriate sinus tachycardia
 - POTS – tachycardia without hypotension on position change

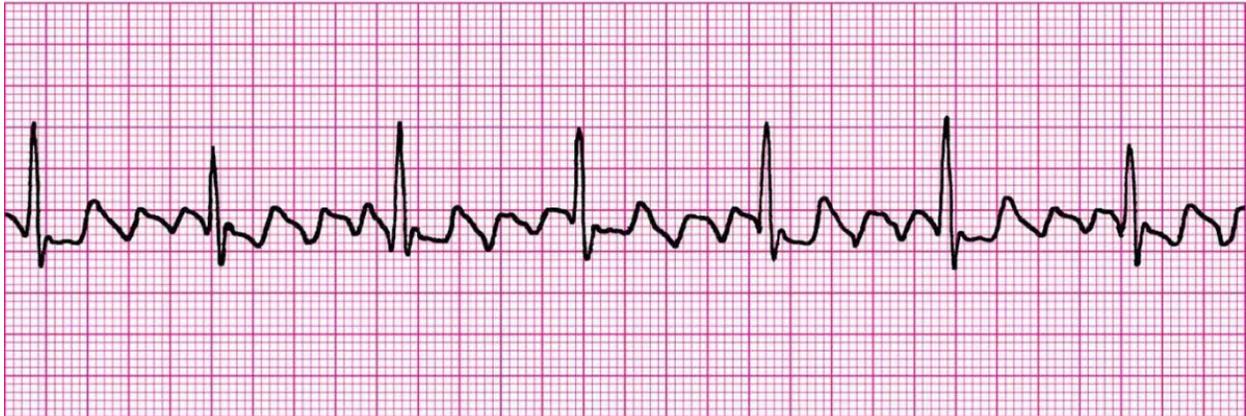


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♥ Atrial Dysrhythmias Review

Atrial Flutter

- Regular
- Atrial rate: 250–400 bpm
- Sawtooth F waves



Atrial Fibrillation

- Irregular
- No distinct P waves
- May present with RVR
- RVR often causes instability
- CRISP Reference:
 - If asked “Is there a P wave?” → NO



NEW Block 4 Rhythms (NCLEX-Relevant)

Premature Ventricular Contractions (PVCs)

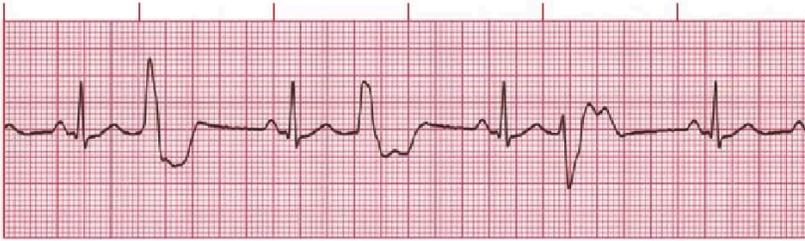
- Impulse originates in ventricle
- Occurs before next sinus beat
- Wide QRS ≥ 0.12 sec
- Bizarre appearance
- Do they produce a pulse?

- How many per minute?
- Patterns:
 - Bigeminy → every other beat
 - Trigeminy → every third beat
- Causes:
 - Caffeine, nicotine, alcohol
 - Ischemia or infarction
 - Heart failure
 - Tachycardia
 - Digitalis toxicity
 - Hypoxia
 - Acidosis
 - Hypokalemia
- Rhythm strips commonly shown in Lead II

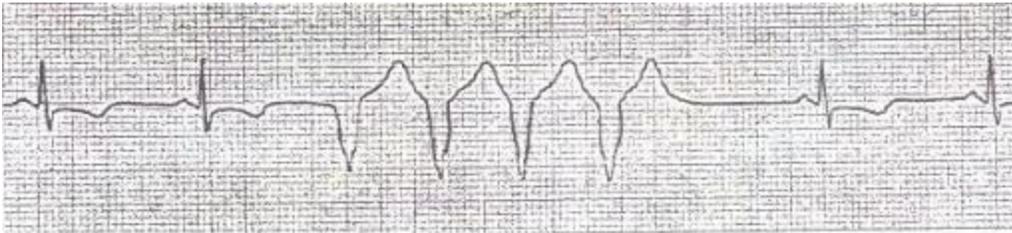
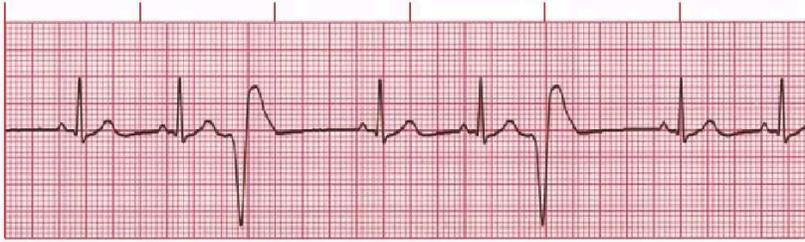
Premature Ventricular Contraction (PVC)



Premature Ventricular Contraction: Ventricular Bigeminy (PVC every other beat)



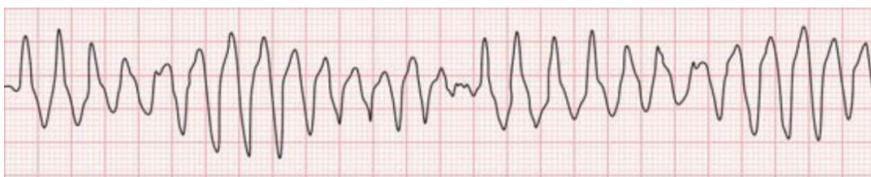
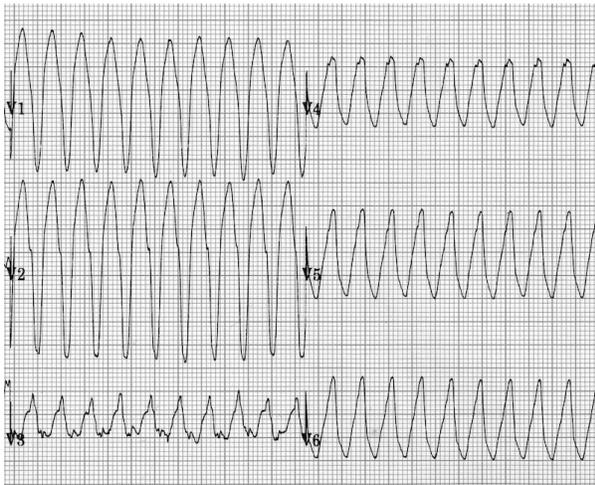
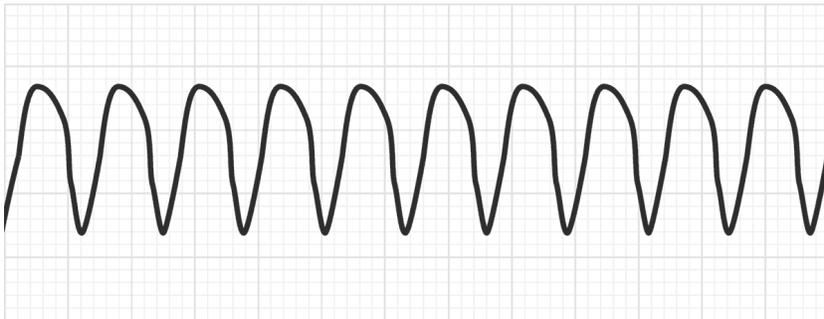
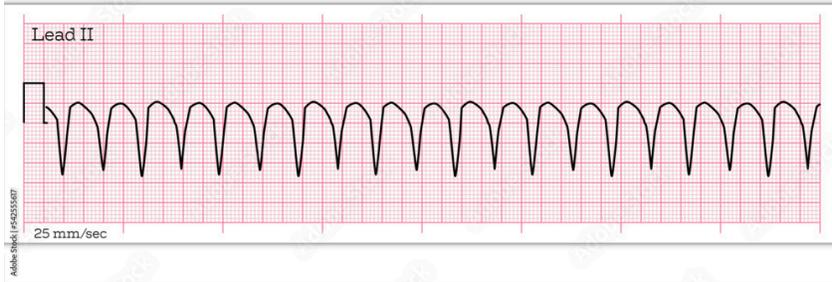
Premature Ventricular Contraction: Ventricular Trigeminy (PVC every 3rd beat)



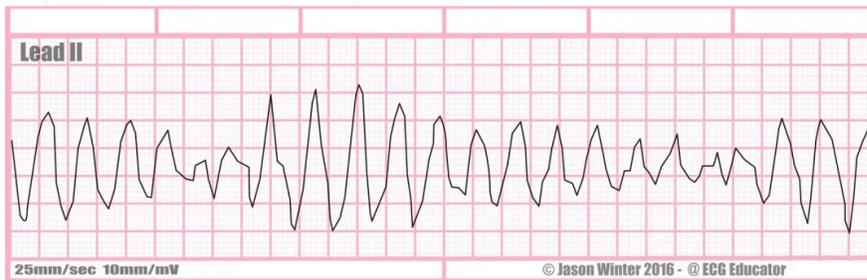
⚡ Ventricular Tachycardia (VT)

- ≥ 3 PVCs in a row
- Rate > 100 bpm
- Types:
 - **Monomorphic** \rightarrow regular, consistent QRS
 - **Polymorphic** \rightarrow irregular (torsades de pointes)
- ⚠ Life-threatening
- **May have pulse or no pulse**

Ventricular Tachycardia Monomorphic

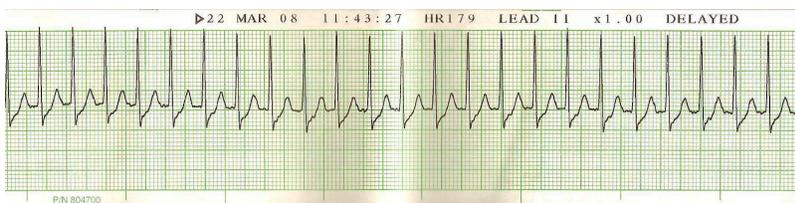


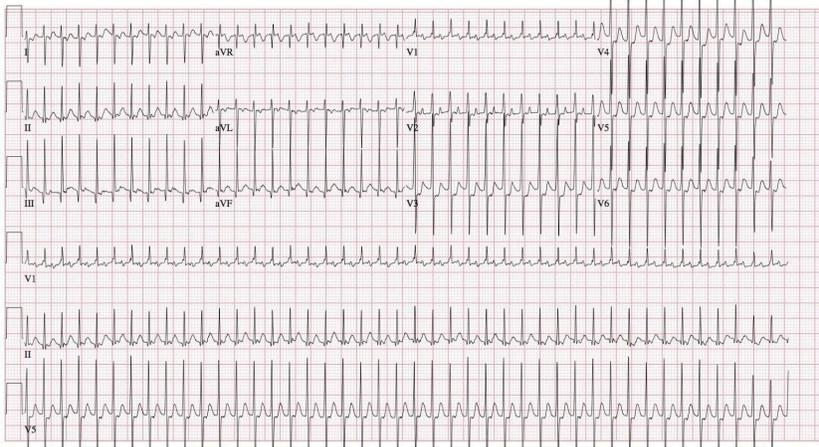
Polymorphic Ventricular Tachycardia (PVT)



⚡ Supraventricular Tachycardia (AVNRT)

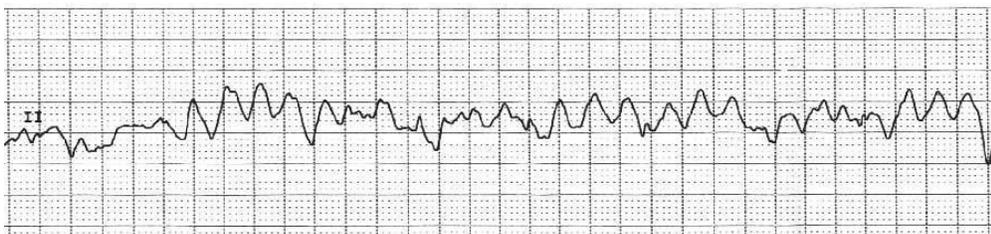
- Originates in AV node
- Impulse loops repeatedly
- Rate: 120–200 bpm
- P waves often hidden in T waves
- CRISP Reference:
 - If unsure P vs T → say NO
- Triggers:
 - Caffeine
 - Nicotine
 - Hypoxemia
 - Stress
- More common in females
- Often no structural heart disease





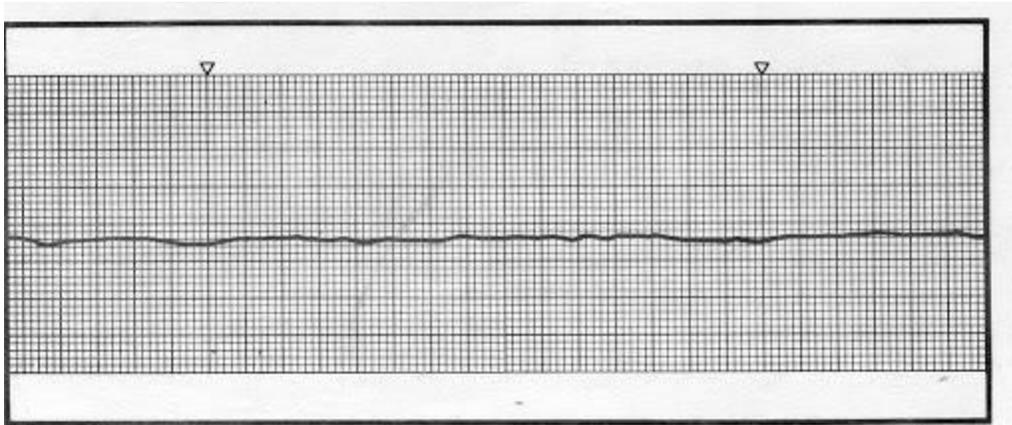
⚡ Ventricular Fibrillation

- Most common rhythm in cardiac arrest
- Chaotic, disorganized
- Ventricles quiver → no contraction
- No pulse – ever
- If a pulse is present → NOT vfib



⚡ Asystole

- No ventricular activity
- Confirmed in two leads
- No pulse, no respirations, no cardiac output
- ❌ Cannot defibrillate
- Check another lead to rule out fine vfib



⚡ Pulseless Electrical Activity (PEA)

- Electrical activity on monitor
- No effective contraction
- No pulse
- Rhythm may appear sinus
- If no pulse → CPR immediately
- Causes:
 - Hypovolemia (hemorrhage)
 - MI

- Massive PE
 - Hyperkalemia
 - Hypothermia
 - Severe hypoxia
 - Drug overdose
-

■ NCLEX Test-Plan Rhythms to KNOW WELL

1. Sinus bradycardia
 2. PVCs
 3. Ventricular tachycardia
 4. Fibrillation (atrial & ventricular)
-

★ Final Block 4 Takeaways

- This is the end of telemetry content for Block 4
- Not included:
 - Heart blocks
 - Idioventricular rhythms
 - Advanced 12-lead interpretation
- Want more?
 - ACLS
 - Advanced ECG courses
- One of the best study tools is FREE
 - 👉 [SkillStat.com](https://www.skillstat.com) for rhythm practice

