

Chapter 5: Junctional Rhythms

Dr. Alice Matthews

amatthews@concorde.edu · Concorde Career College Portland

After this chapter you should be able to recognize premature junctional complexes; identify junctional escape beats and junctional escape rhythm; distinguish accelerated junctional rhythm from junctional tachycardia; and explain why junctional beats produce inverted, buried, or retrograde P waves and a short PR interval. **Reading: Aehlert, *ECGs Made Easy*, 7th ed., Chapter 5 (p. 129 to 150).**

Note to students: Rates and cutoffs in this guide follow **Aehlert, 7th edition**, because that is the edition this guide follows. Other references disagree on some of these numbers, and that is normal rather than a sign that someone is wrong. Accelerated junctional rhythm is the example you will trip over: this guide uses **61 to 100**, so the band starts one beat above the top of the escape range and the two never share a boundary. Some sources write 60 to 100 instead. Nothing about the rhythm changes; only where a single beat per minute gets counted. When a practice question online conflicts with this guide, answer from the textbook. **What the last chapter gives you:** atrial rhythms taught you to hunt for the P wave and to check whether it looks like the sinus P. This chapter keeps that habit and adds one twist, which is that here the P wave can be upside down, hidden, or standing behind the QRS.

At a Glance: this chapter in one box

Numbers you must know

- Intrinsic rate of the AV junction: **40 to 60**.
- Junctional escape **40 to 60**; accelerated junctional **61 to 100**; junctional tachycardia **101 to 180**.
- Junctional PR interval is **under 0.12 s**, and only when the P wave comes before the QRS.
- QRS stays **narrow, 0.06 to 0.10 s**, at every rate on that ladder.

The one rule this chapter is built on

- The junction sits **below** the atria, so it depolarizes them **backward**, away from the positive electrode of lead II. Away from positive writes a **downward** deflection. That is the inverted P wave, and every other finding in this chapter follows from it.

Top 3 traps

- Reading “accelerated” as fast for the patient. It is fast for the *junction* only.
- Calling every early narrow beat a PJC. Premature junctional complexes are the **least common** of the three; think atrial first.
- Suppressing an escape rhythm. It is the failsafe doing its job, not the disease.

Coming Next Chapter: This Same Pattern, One Level Down

Everything you learn here repeats one level further down the conduction system. Same escape hierarchy, same three-speed ladder, same single question about QRS width. Learn the parallel now and you arrive at the ventricular rhythms already holding half of them.

	Junctional (this chapter)	Ventricular (next chapter)
Escape	Junctional escape, 40 to 60	Idioventricular, 20 to 40
Accelerated	Accelerated junctional, 61 to 100	AIVR, 41 to 100
Tachycardia	Junctional tachycardia, 101 to 180	Ventricular tachycardia, over 100
QRS	Narrow , it used the fast track	Wide , it took the detour
P waves	Inverted, buried, or retrograde	Absent or dissociated

The Backup Pacemaker Chain

Every level of the conduction system can pace the heart on its own, and every level has its own built-in speed: **SA node 60 to 100, AV junction 40 to 60, ventricles 20 to 40**. Think of them as backup generators wired in series. The fastest one running takes the load and holds the slower ones quiet, which is why a healthy heart shows you only the SA node. If the mains drop, the generator in the basement starts. Nobody is ever left without a pacemaker, but **each demotion costs rate**.

That gives you exactly two stories, and one of them is behind every junctional rhythm you will ever read. Either the **SA node failed or slowed** below the junction's own speed, and the junction stepped up to cover, which is an **escape**. Or the **junction became irritable** and started firing faster than the SA node, stealing beats that were not offered, which is a **usurper**. Ask which story you are looking at before you ask anything else, because the answer changes the treatment completely.

The One-Way Street, Driven Backward

You already know the deflection rule from the electrophysiology chapter: current traveling **toward** the positive electrode writes an **upward** deflection, and current traveling **away** from it writes a **downward** one. Lead II's positive electrode sits at the left leg, so a sinus impulse sweeping down and left across the atria is heading straight at the camera, and you get an upright P wave.

The AV junction sits downstream of the atria. To depolarize them at all, it has to push the impulse back **up** the one-way street, which is travel **away** from that same positive electrode. Away from positive means a downward deflection. That is the whole explanation for the inverted P wave. It is not a new rule and it is not a damaged atrium; it is that same deflection rule read in reverse.



Normal sinus complexes at 75, shown for contrast. Every P wave here is **upright** because the impulse ran toward the positive electrode. In every rhythm on the following pages, that P wave is inverted, buried, or standing after the QRS, while the rest of the complex looks exactly like this.

The Three P Wave Addresses

When the junction fires, the impulse leaves in two directions at once: **up** toward the atria and **down** toward the ventricles. It is a footrace out of one starting block, and whichever chamber finishes first gets written on the paper first. Where the focus sits inside the junction decides who wins.

- **High in the junction:** the atria are closer, so they depolarize first and the inverted P lands **before** the QRS.
- **Mid junction:** both finish together, and the P wave is **buried inside the QRS**, invisible.

- **Low in the junction:** the ventricles are closer and win, so the inverted P lands **after** the QRS. This is the retrograde P.

One variable, three outcomes. That is far less to carry than three memorized facts, and it explains why the same rhythm can look like three different rhythms from strip to strip.

Short PR, because the trip is shorter. A sinus impulse has to cross both atria before it reaches the ventricles. A junctional impulse starts at the junction, already most of the way there. Less distance means less time, so the PR interval measures **under 0.12 s**. The caveat matters as much as the rule: **the PR is only measurable if the P wave comes before the QRS**. If it is buried or retrograde, there is no PR interval to report, and writing one down is a wrong answer rather than a careless one.

Narrow QRS proves the exit was normal. Whatever the P wave is doing, the impulse still drops into the bundle of His, the bundle branches, and the Purkinje fibers by the normal high-speed route. Both ventricles depolarize together and fast, so the QRS stays **0.06 to 0.10 s**. This is the bundle branch bifurcation rule from the electrophysiology chapter, and it is the same rule that will make every ventricular rhythm wide.

Premature Junctional Complex (PJC)

★ an early beat that interrupts the underlying rhythm

Regularity	Underlying rhythm is regular; the PJC interrupts it early
Rate	Underlying rate is unaffected
P waves	Inverted in lead II when visible; before, buried inside, or after the QRS
PR	Under 0.12 s when the P precedes the QRS; not measurable otherwise
QRS	Narrow , 0.06 to 0.10 s

Causes Caffeine, nicotine, and other stimulants, hypoxia, heart failure, digoxin toxicity, and electrolyte disturbance.

Patient Usually nothing. Some patients feel a skipped beat or a thump. An isolated PJC in a well patient is not treated; you treat the cause behind it, if there is one.

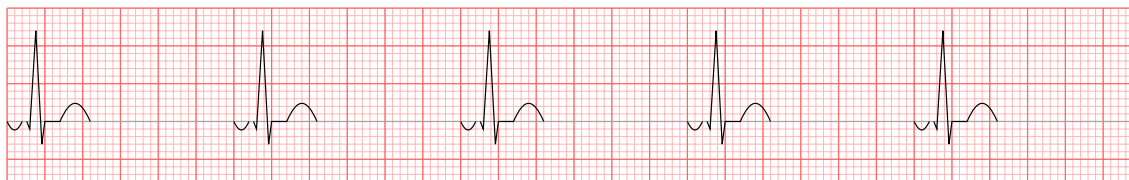
Memory hook Usurper versus rescuer. A PJC is the person who cuts into the front of the line. A junctional escape beat is the substitute teacher who showed up because the regular teacher did not. You correct the line-cutter; you do not fire the substitute.

Fast tell It is *early*. A PJC and a junctional escape beat are morphologically identical, so timing is the entire distinction, and it is a caliper question rather than a shape question.

Where students go wrong Two things. PJCs are notably **less common** than atrial or ventricular premature complexes, so an early narrow beat should send you looking for a hidden atrial P wave first; think PAC before PJC. And do not build an answer on the pause that follows: **the pause after a PJC is variable, sources disagree on whether it is compensatory, and pause type is not a reliable way to identify a PJC.**

Junctional Escape Rhythm

★ the failsafe, running at its own intrinsic rate



Address one, the P wave **before** the QRS. Rate 50, and the P wave is inverted because the junction fired the atria backward. The PR measures under 0.12 s, because the trip started most of the way down.

Regularity	Regular
Rate	40 to 60
P waves	Inverted in lead II when visible; before, buried inside, or after the QRS
PR	Under 0.12 s when the P precedes the QRS; not measurable otherwise
QRS	Narrow , 0.06 to 0.10 s

Causes Anything that silences or slows the SA node below 40 to 60. **Increased vagal tone, including during normal sleep**, is common and benign. Also SA node disease, inferior wall myocardial infarction, digoxin toxicity, and beta blocker or calcium channel blocker effect.

Patient Many patients at 50 feel nothing at all, especially if this is happening at 3 a.m. A symptomatic patient shows you

low output: lightheadedness, hypotension, altered mental status. **Support the rate, do not abolish the rhythm.** Atropine, transcutaneous pacing, and correction of the underlying cause.

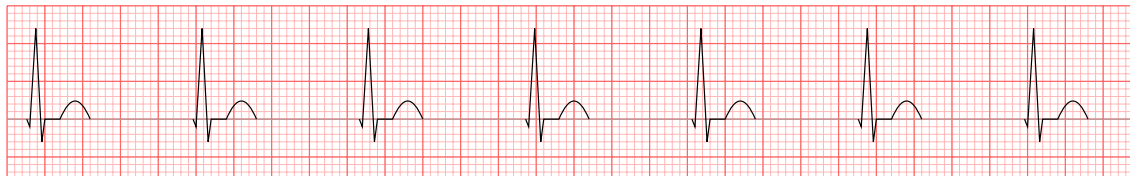
Memory hook The backup generator in the basement. It only starts when the mains drop, and it runs at lower output by design. Nobody unplugs the generator because they dislike the flicker.

Fast tell It is *late*, not early. The beat arrives after a pause because the expected sinus beat never came. Pick up the calipers and prove it.

Where students go wrong Reaching for a rhythm-suppressing drug. **A junctional escape rhythm at 45 is not the problem; it is the answer to a problem happening higher up.** Abolish it and you may have removed the only pacemaker the patient has left.

Accelerated Junctional Rhythm

★ the same focus, running above its own baseline



Address two, the P wave **buried** inside the QRS. Rate 68, regular, narrow, and no P wave anywhere on the strip. There is no PR interval to report here, and reporting one would be wrong rather than careless.

Regularity Regular

Rate 61 to 100

P waves Inverted in lead II when visible; frequently buried and reported as absent

PR Under 0.12 s when the P precedes the QRS; **not measurable** otherwise

QRS Narrow, 0.06 to 0.10 s

Causes Digoxin toxicity is the signature cause and is worth naming every single time this rhythm appears. Also inferior wall myocardial infarction, rheumatic fever, and the patient recovering from cardiac surgery.

Patient Usually well tolerated, because the rate itself is in the normal range. The risk is not the rhythm; it is missing what caused it. A patient on digoxin with a regular narrow-complex rhythm in the 70s and no visible P waves is a digoxin level waiting to be ordered.

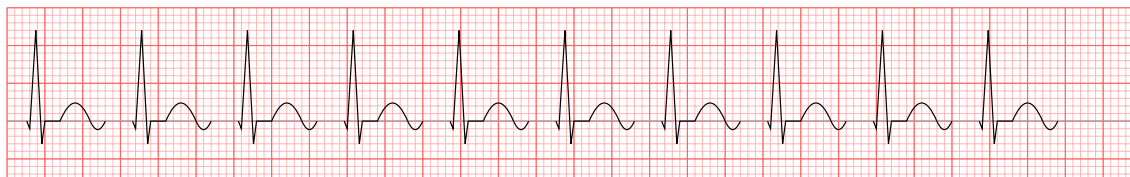
Memory hook A car in first gear at high RPM. The engine is screaming even though the car is not moving fast. “Accelerated” describes the *tissue*, not the patient.

Fast tell A normal-looking rate with wrong-looking or missing P waves. When the number is boring and the P waves are not, slow down and look harder.

Where students go wrong Reading “accelerated” as tachycardic and then rejecting the diagnosis because the rate is 80. That reasoning is backwards; see the trap box below.

Junctional Tachycardia

★ the top of the same ladder, and a supraventricular tachycardia



Address three, the retrograde P wave **after** the QRS. Rate 107, still narrow, still regular. Look for the small downward deflection riding on the tail of each T wave; that is the inverted P, and at faster rates it disappears into the T wave completely.

Regularity Regular

Rate 101 to 180

P waves Inverted when visible, but at these rates the P is often lost inside the preceding T wave

PR Under 0.12 s when measurable, and frequently it is not

QRS Narrow, 0.06 to 0.10 s

Causes Digoxin toxicity, myocardial infarction, and the postoperative cardiac surgery patient.

Patient A fast rate cuts filling time, so cardiac output can fall even though every complex looks tidy. Junctional tachycardia at 170 can drop a blood pressure quickly. Assess the patient, not the strip.

Why it counts as an SVT Junctional tachycardia is classified as a **supraventricular** tachycardia because the impulse originates **above the ventricles**. That is the same fact that keeps the QRS narrow, so the classification and the measurement are two views of one thing. “SVT” is the honest label to use when the rate is fast enough that you cannot find the P wave at all; naming it atrial or junctional requires finding that P and seeing which way it points.

Memory hook One dimmer switch, not three light bulbs. Junctional 40 to 60, accelerated junctional 61 to 100, junctional tachycardia 101 to 180. The lamp never changes; only the brightness does.

Fast tell Regular, narrow, fast, and no findable P wave. Call it SVT out loud, then go hunting for the P wave to narrow it down.

Where students go wrong Believing that narrow means stable. **Narrow tells you where the impulse started, not how the patient is doing.**

Common Trap

Your patient’s junctional rhythm is running at 80. Why on earth is that called “accelerated” when 80 is a perfectly normal heart rate?

Because **accelerated is measured against the tissue’s own baseline, not against the patient’s normal heart rate**. The AV junction’s intrinsic rate is 40 to 60. A junction running at 80 is going at close to double its own speed, and something is driving it to do that. The number on the monitor looks unremarkable; the tissue producing it is not behaving normally at all.

This is the single most common misread in the chapter, and it goes wrong in both directions: students reject accelerated junctional rhythm because “80 is normal,” and they call junctional tachycardia at 110 “accelerated” because it does not feel fast enough. **Read the word as a statement about the junction, and the whole ladder falls into place.**

Common Trap

A patient with known atrial fibrillation is admitted on digoxin. Overnight the monitor tech notices the rhythm has become regular. Is that an improvement?

No. It is one of the most quietly dangerous findings on the floor. **Regular atrial fibrillation is not a thing**. Fibrillating atria bombard the AV node at random, so the ventricular response is irregularly irregular by definition. If those narrow complexes have marched into a regular rhythm, the atrial impulses are no longer getting through at all: this is **complete heart block with a junctional escape rhythm taking over below it**, and the classic cause is **digoxin toxicity**. The pattern has a name worth remembering, **regularized atrial fibrillation**.

The reasoning generalizes past this one case. When an irregular rhythm suddenly becomes regular, do not record it as improvement. Ask what took over.

Before You Move On

You should now be able to:

- explain the inverted P wave from the deflection rule rather than memorizing it
- place the P wave in its three possible addresses and say what each tells you about where the focus sits
- state the junctional ladder from escape through accelerated to tachycardia
- explain why 60 to 100 counts as accelerated here, when it would be a normal rate anywhere else

The next chapter repeats this same pattern one level further down, in the ventricles. Same hierarchy, same three speeds, one question about QRS width.