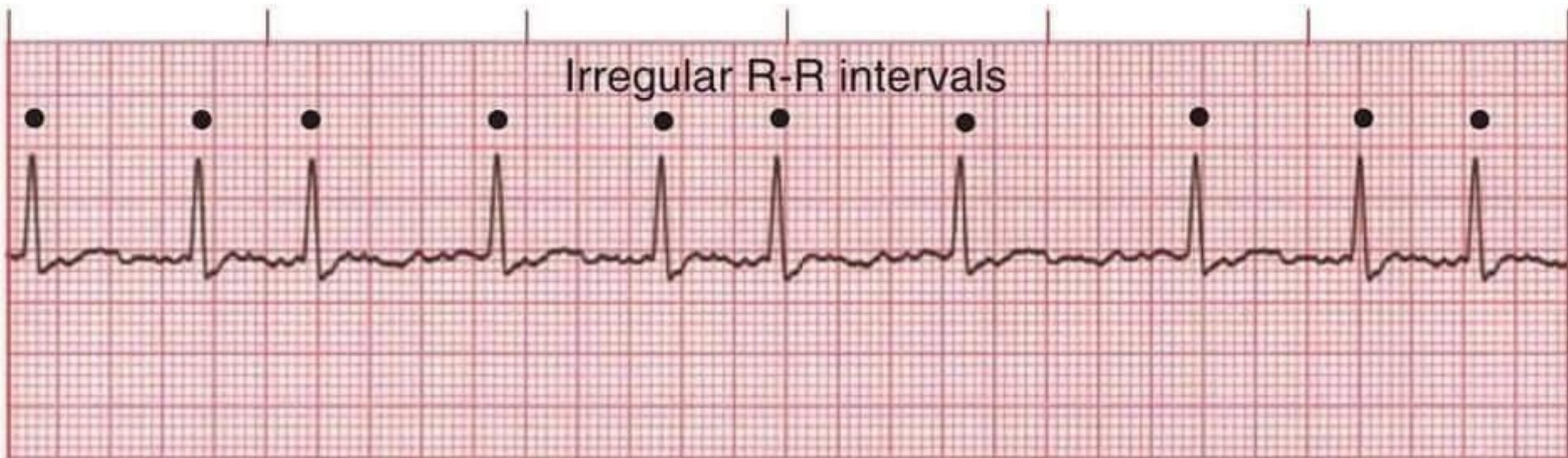


Atrial Fibrillation (A-fib)

- Rapid, erratic electrical discharge comes from multiple atrial ectopic foci.
- No organized atrial contractions are detectable.



Rate: Atrial: 350 bpm or greater; ventricular: slow or fast

Rhythm: Irregular

P Waves: No true P waves; chaotic atrial activity

PR Interval: None

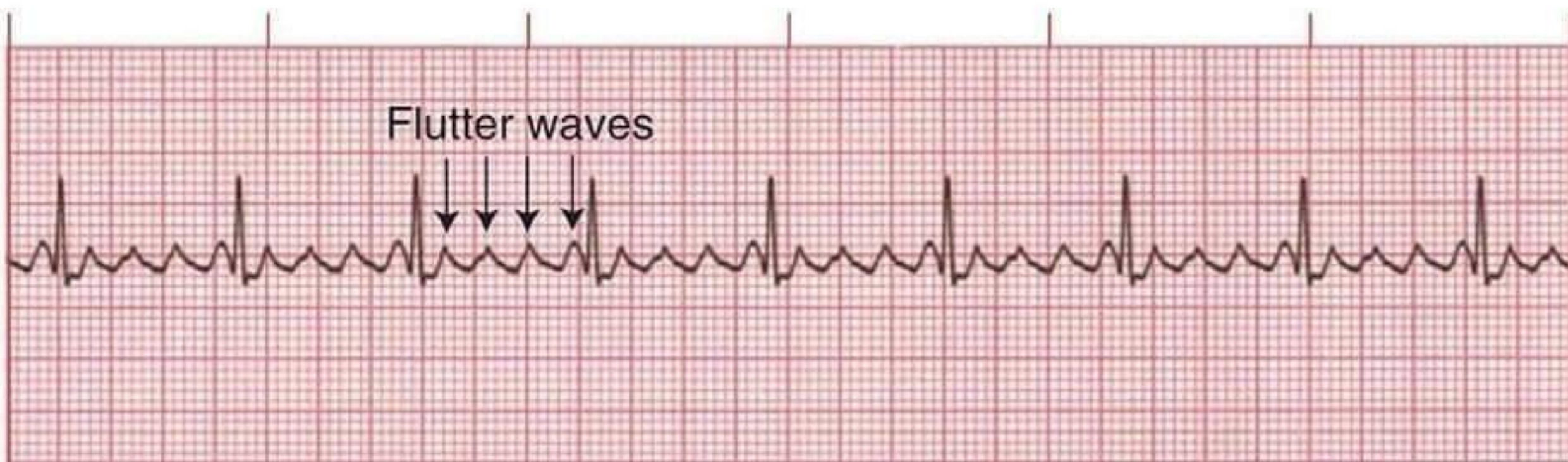
QRS: Normal (0.06–0.10 sec)

- ♥ **Clinical Tip:** A-fib is usually a chronic arrhythmia associated with underlying heart disease.
- ♥ **Clinical Tip:** Signs and symptoms depend on ventricular response rate.



Atrial Flutter (A-flutter)

- AV node conducts impulses to the ventricles at a 2:1, 3:1, 4:1, or greater ratio (rarely 1:1).
- Degree of AV block may be consistent or variable.



Rate: Atrial: 250–350 bpm; ventricular: slow or fast

Rhythm: Usually regular but may be variable

P Waves: Flutter waves have a saw-toothed appearance

PR Interval: Variable

QRS: Usually normal (0.06–0.10 sec), but may appear widened if flutter waves are buried in QRS

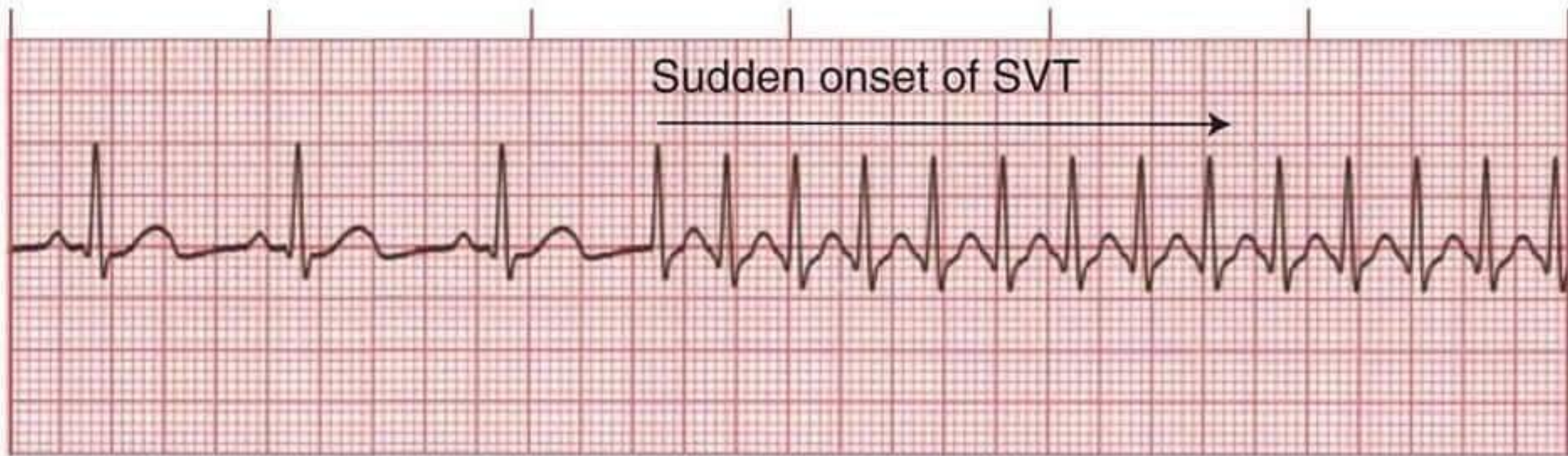
♥ **Clinical Tip:** The presence of A-flutter may be the first indication of cardiac disease.

♥ **Clinical Tip:** Signs and symptoms depend on ventricular response rate.



Paroxysmal Supraventricular Tachycardia (PSVT)

- PSVT is a rapid rhythm that starts and stops suddenly.
- For accurate interpretation, the beginning or end of the PSVT must be seen.
- PSVT is sometimes called paroxysmal atrial tachycardia (PAT).



Rate: 150–250 bpm

Rhythm: Regular

P Waves: Frequently buried in preceding T waves and difficult to see

PR Interval: Usually not possible to measure

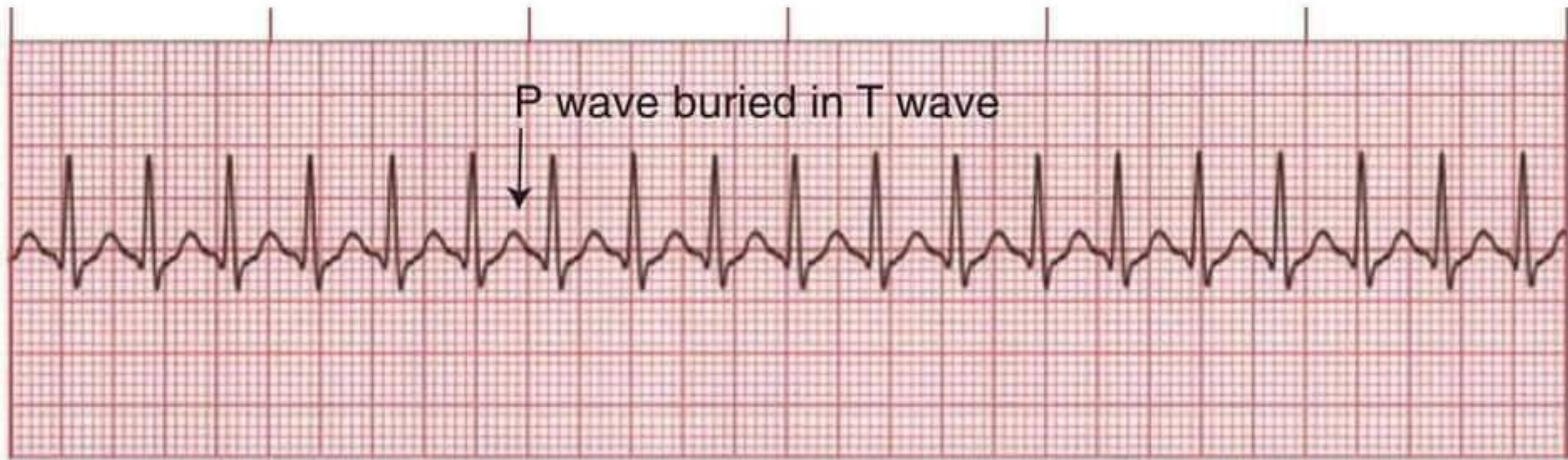
QRS: Normal (0.06–0.10 sec) but may be wide if abnormally conducted through ventricles

♥ **Clinical Tip:** The patient may feel palpitations, dizziness, lightheadedness, or anxiety.



Supraventricular Tachycardia (SVT)

■ This arrhythmia has such a fast rate that the P waves may not be seen.



Rate: 150–250 bpm

Rhythm: Regular

P Waves: Frequently buried in preceding T waves and difficult to see

PR Interval: Usually not possible to measure

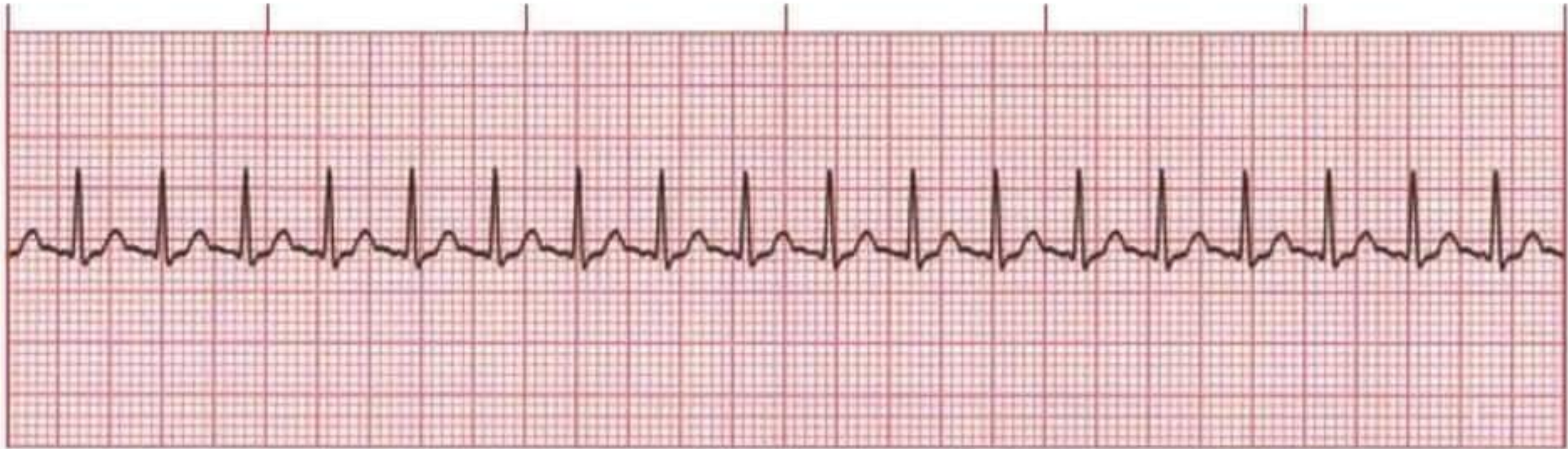
QRS: Normal (0.06–0.10 sec) but may be wide if abnormally conducted through ventricles

♥ **Clinical Tip:** SVT may be related to caffeine intake, nicotine, stress, or anxiety in healthy adults.



Atrial Tachycardia

- A rapid atrial rate overrides the SA node and becomes the dominant pacemaker.
- Some ST wave and T wave abnormalities may be present.



Rate: 150–250 bpm

Rhythm: Regular

P Waves: Normal (upright and uniform) but differ in shape from sinus P waves

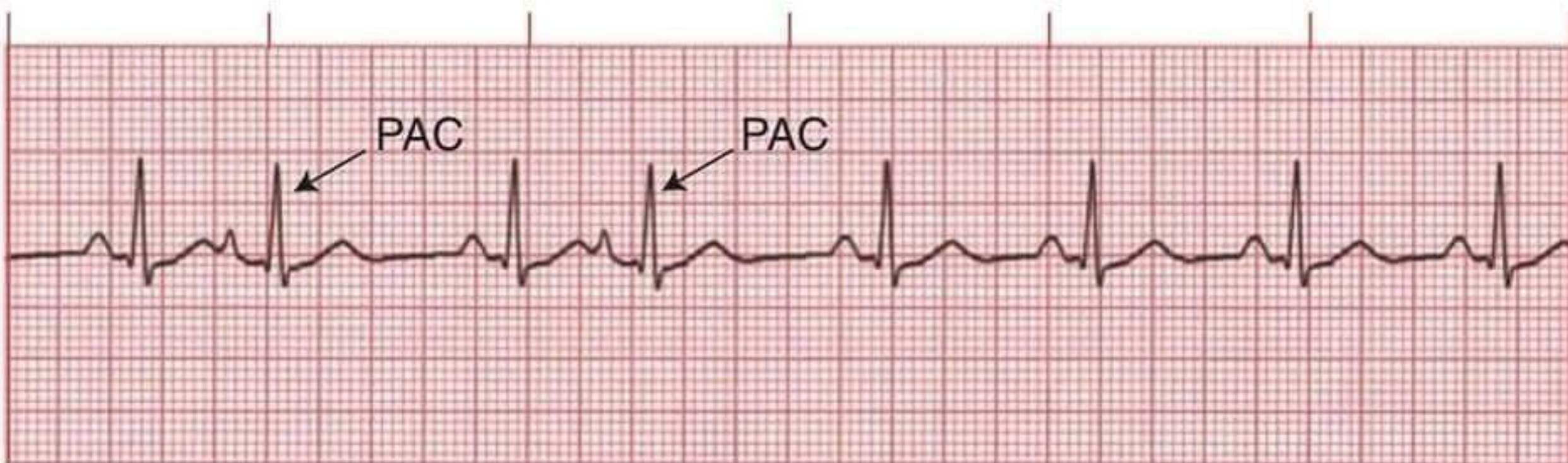
PR Interval: May be short (<0.12 sec) in rapid rates

QRS: Normal (0.06–0.10 sec) but can be aberrant at times



Premature Atrial Contraction (PAC)

- A single complex occurs earlier than the next expected sinus complex.
- After the PAC, sinus rhythm usually resumes.



Rate: Depends on rate of underlying rhythm

Rhythm: Irregular whenever a PAC occurs

P Waves: Present; in the PAC, may have a different shape

PR Interval: Varies in the PAC; otherwise normal (0.12–0.20 sec)

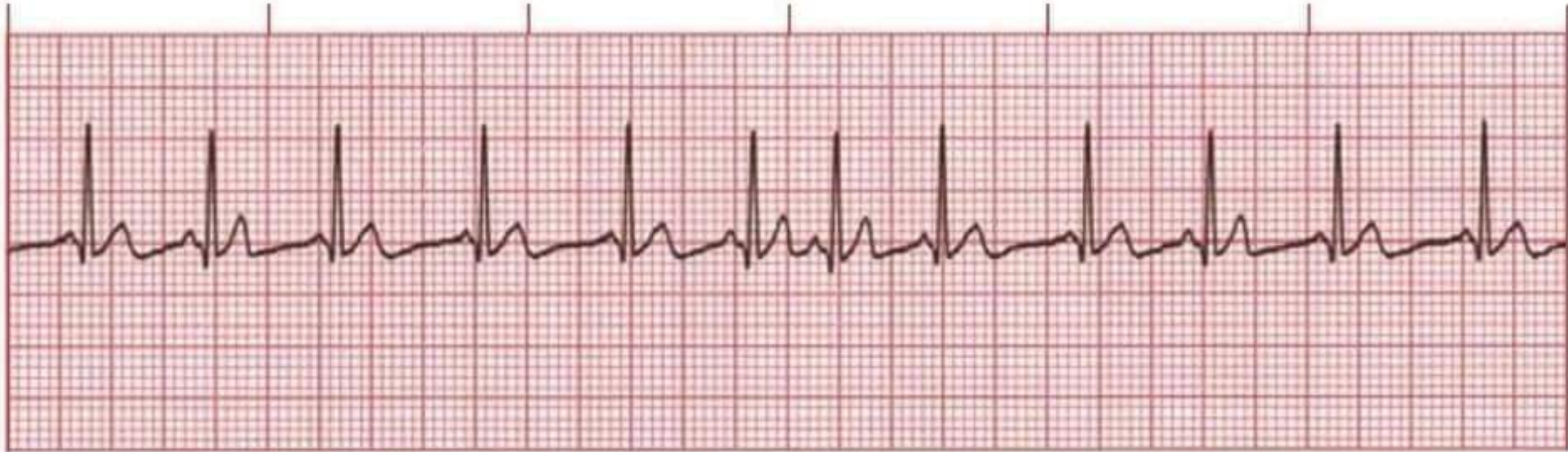
QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** In patients with heart disease, frequent PACs may precede paroxysmal supraventricular tachycardia (PSVT), A-fib, or A-flutter.



Multifocal Atrial Tachycardia (MAT)

- This form of WAP is associated with a ventricular response of >100 bpm.
- MAT may be confused with atrial fibrillation (A-fib); however, MAT has a visible P wave.



Rate: Fast (>100 bpm)

Rhythm: Irregular

P Wave: At least three different forms, determined by the focus in the atria

PR Interval: Variable; depends on focus

QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** MAT is commonly seen in patients with COPD but may also occur in acute MI.

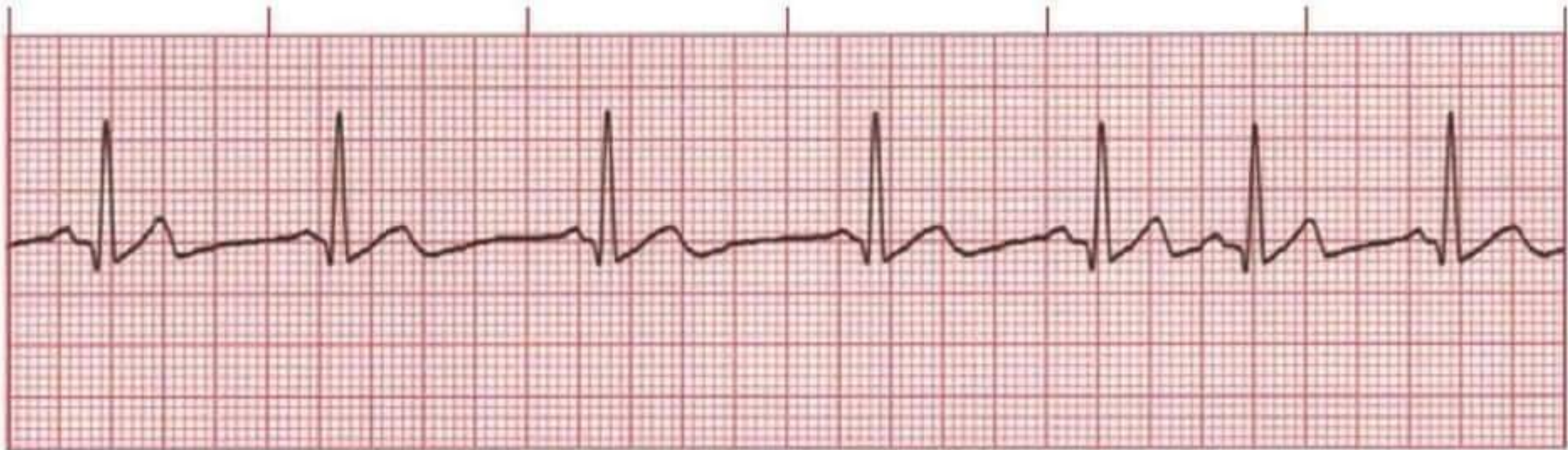


Atrial Arrhythmias

- P Waves differ in appearance from sinus P waves.
- QRS Complexes are of normal duration.

Wandering Atrial Pacemaker (WAP)

- Pacemaker site transfers from the SA node to other latent pacemaker sites in the atria and the AV junction and then moves back to the SA node.



Rate: Normal (60–100 bpm)

Rhythm: Irregular

P Waves: At least three different forms, determined by the focus in the atria

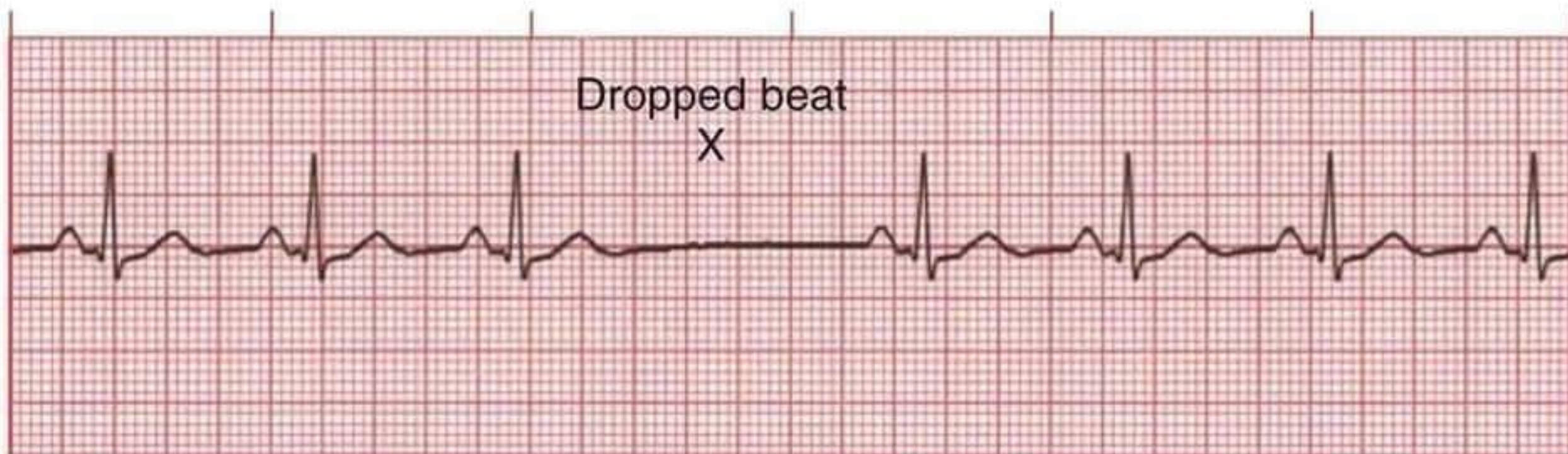
PR Interval: Variable; determined by focus

QRS: Normal (0.06–0.10 sec)



Sinoatrial (SA) Block

- The block occurs in some multiple of the P-P interval.
- After the dropped beat, cycles continue on time.



Rate: Normal to slow; determined by duration and frequency of SA block

Rhythm: Irregular whenever an SA block occurs

P Waves: Normal (upright and uniform) except in areas of dropped beats

PR Interval: Normal (0.12–0.20 sec)

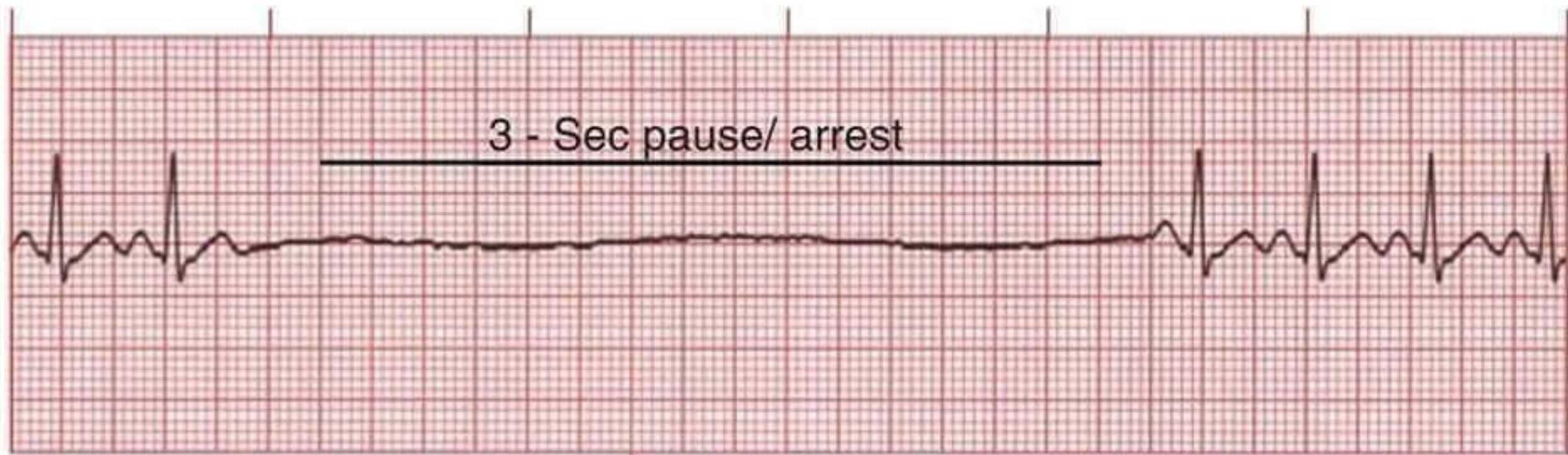
QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Cardiac output may decrease, causing syncope or dizziness.



Sinus Pause (Sinus Arrest)

- The SA node fails to discharge and then resumes.
- Electrical activity resumes either when the SA node resets itself or when a lower latent pacemaker begins to discharge.
- The pause (arrest) time interval is not a multiple of the normal P-P interval.



Rate: Normal to slow; determined by duration and frequency of sinus pause (arrest)

Rhythm: Irregular whenever a pause (arrest) occurs

P Waves: Normal (upright and uniform) except in areas of pause (arrest)

PR Interval: Normal (0.12–0.20 sec)

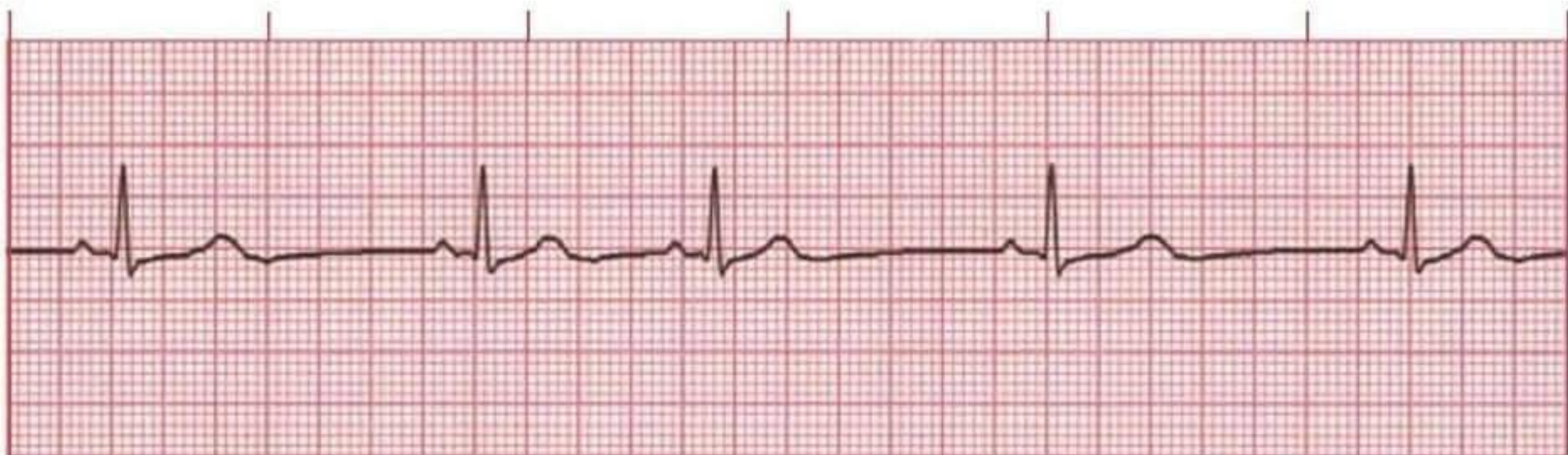
QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Cardiac output may decrease, causing syncope or dizziness.



Sinus Arrhythmia

- The SA node discharges irregularly.
- The R-R interval is irregular.



Rate: Usually normal (60–100 bpm); frequently increases with inspiration and decreases with expiration

Rhythm: Irregular; varies with respiration

P Waves: Normal (upright and uniform)

PR Interval: Normal (0.12–0.20 sec)

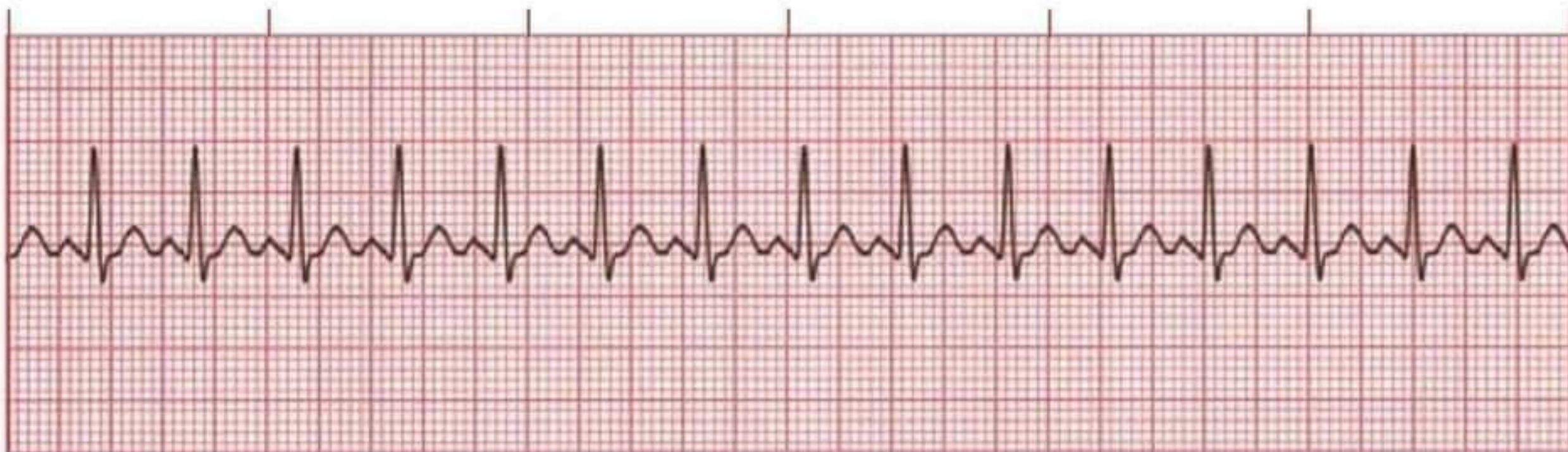
QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** The pacing rate of the SA node varies with respiration, especially in children and elderly people.



Sinus Tachycardia

■ Results from increased SA node discharge.



Rate: Fast (>100 bpm)

Rhythm: Regular

P Waves: Normal (upright and uniform)

PR Interval: Normal (0.12–0.20 sec)

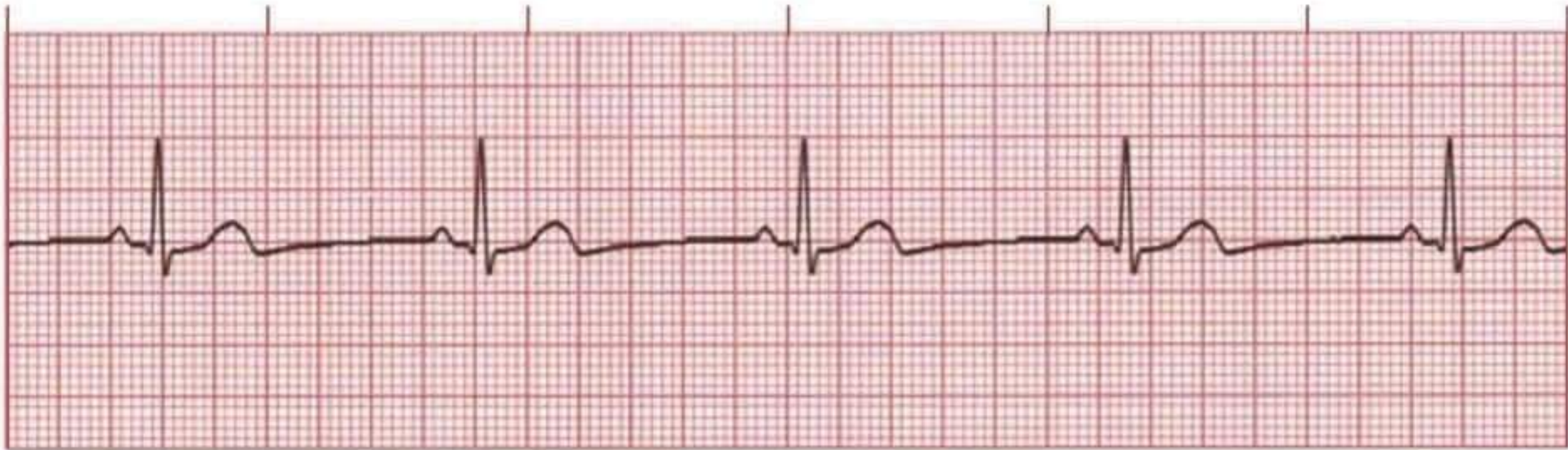
QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Sinus tachycardia may be caused by exercise, anxiety, fever, hypoxemia, hypovolemia, or cardiac failure.



Sinus Bradycardia

■ Results from slowing of the SA node.



Rate: Slow (<60 bpm)

Rhythm: Regular

P Waves: Normal (upright and uniform)

PR Interval: Normal (0.12–0.20 sec)

QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Sinus bradycardia is normal in athletes and during sleep. In acute MI, it may be protective and beneficial or the slow rate may compromise cardiac output. Certain medications, such as beta blockers, may also cause sinus bradycardia.

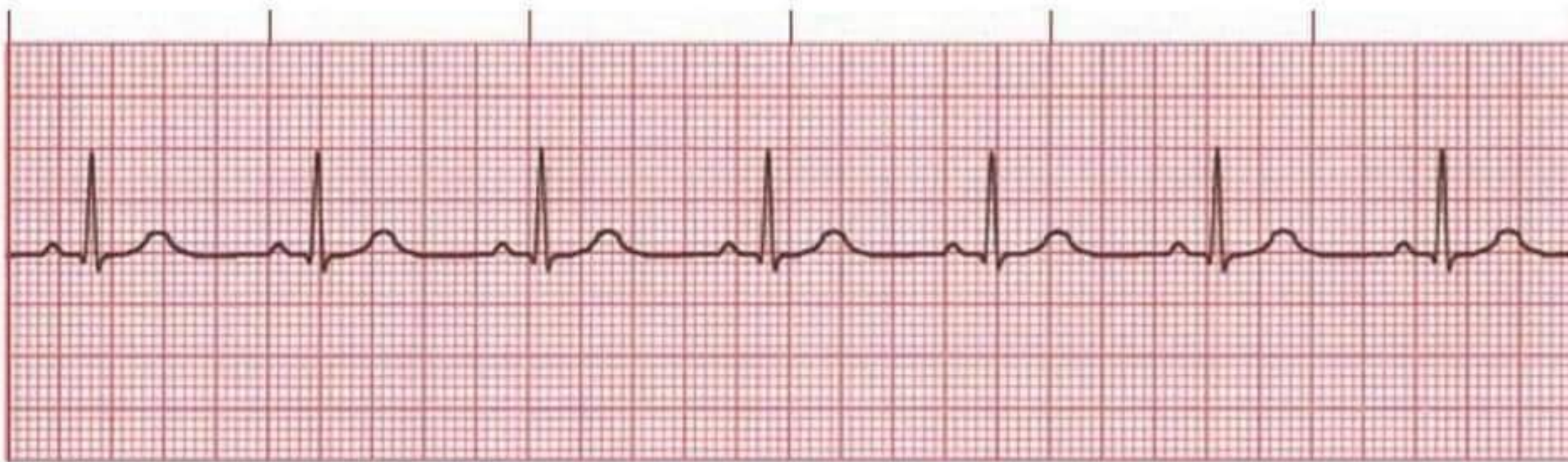


Sinoatrial (SA) Node Arrhythmias

- Upright P waves all look similar.
- PR intervals and QRS complexes are of normal duration.

Note: All ECG strips in this tab were recorded in lead II.

Normal Sinus Rhythm (NSR)



Rate: Normal (60–100 bpm)

Rhythm: Regular

P Waves: Normal (upright and uniform)

PR Interval: Normal (0.12–0.20 sec)

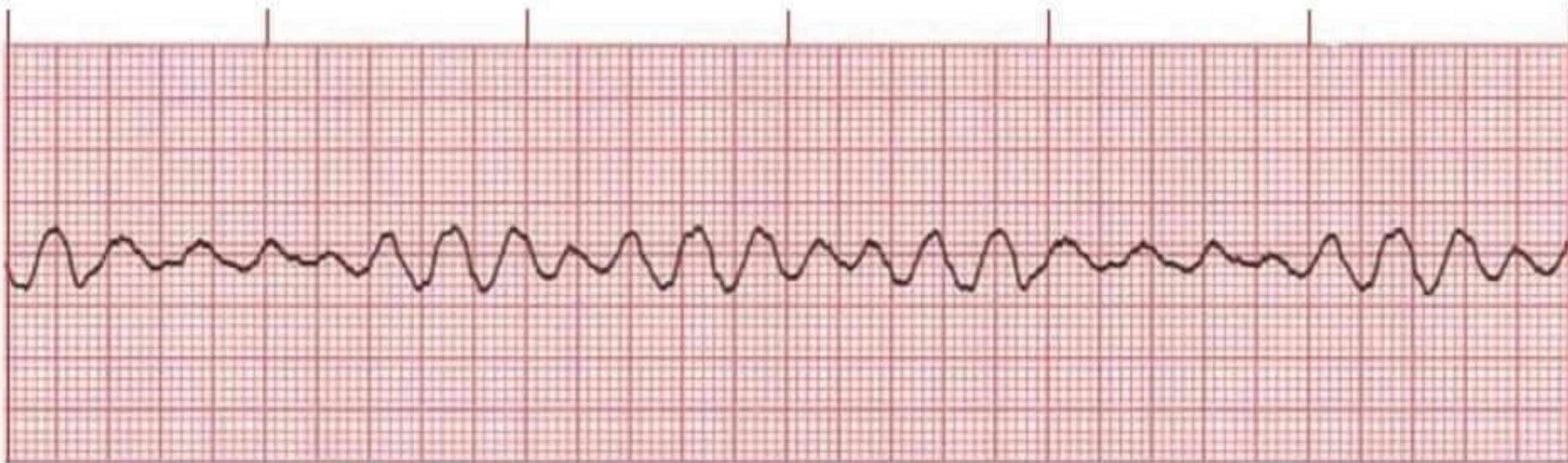
QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** A normal ECG does not exclude heart disease.



Ventricular Fibrillation (VF)

- Chaotic electrical activity occurs with no ventricular depolarization or contraction.
- The amplitude and frequency of the fibrillatory activity can be used to define the type of fibrillation as coarse, medium, or fine.



Rate: Indeterminate

Rhythm: Chaotic

P Waves: None

PR Interval: None

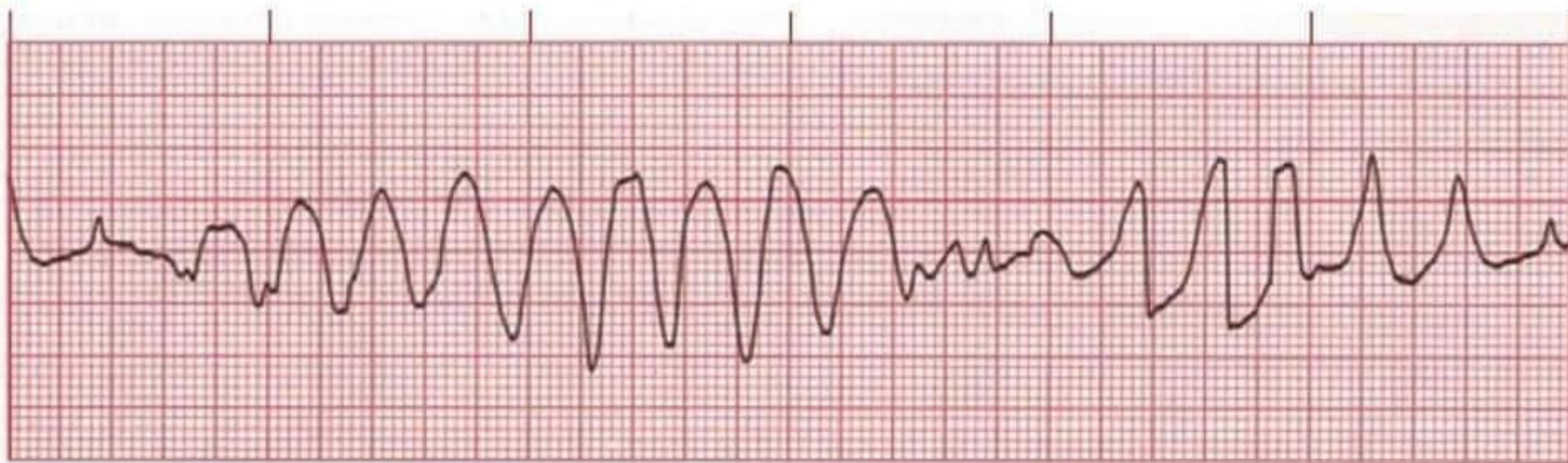
QRS: None

♥ **Clinical Tip:** There is no pulse or cardiac output. Rapid intervention is critical. The longer the delay, the less the chance of conversion.



Torsade de Pointes

- The QRS reverses polarity and the strip shows a spindle effect.
- This rhythm is an unusual variant of polymorphic VT with normal or long QT intervals.
- In French the term means "twisting of the points."



Rate: 200–250 bpm

Rhythm: Irregular

P Waves: None

PR Interval: None

QRS: Wide (>0.10 sec), bizarre appearance

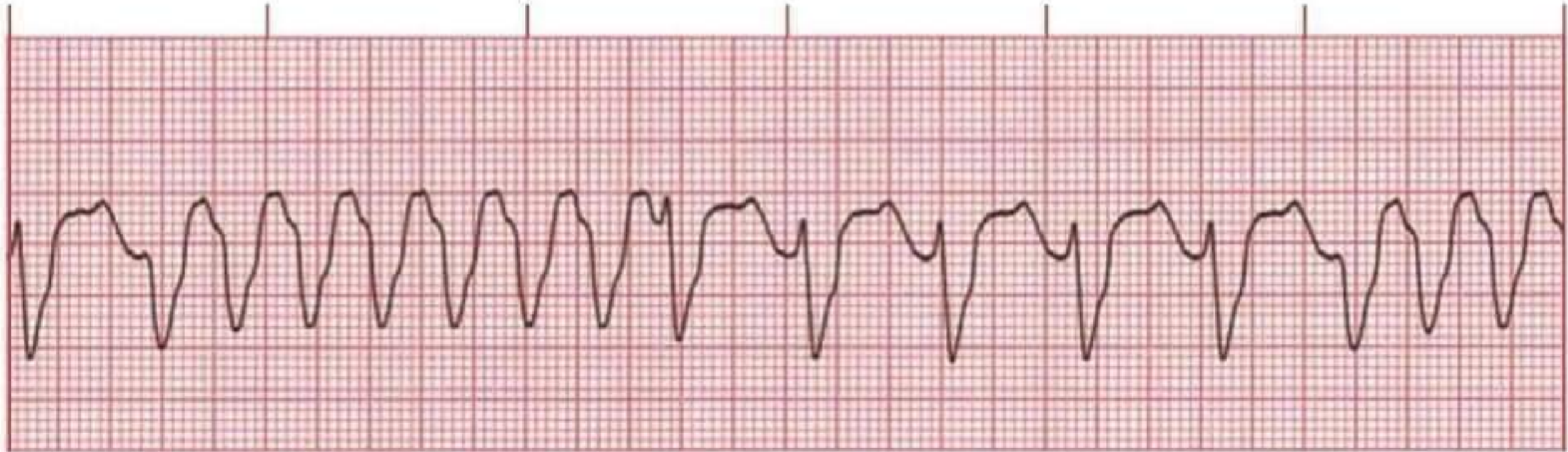
♥ **Clinical Tip:** Torsade de pointes may deteriorate to VF or asystole.

♥ **Clinical Tip:** Frequent causes are drugs that prolong QT interval and electrolyte abnormalities such as hypomagnesemia.



Ventricular Tachycardia (VT): Polymorphic

- QRS complexes in polymorphic VT vary in shape and amplitude.
- The QT interval is normal or long.



Rate: 100–250 bpm

Rhythm: Regular or irregular

P Waves: None or not associated with the QRS

PR Interval: None

QRS: Wide (>0.10 sec), bizarre appearance

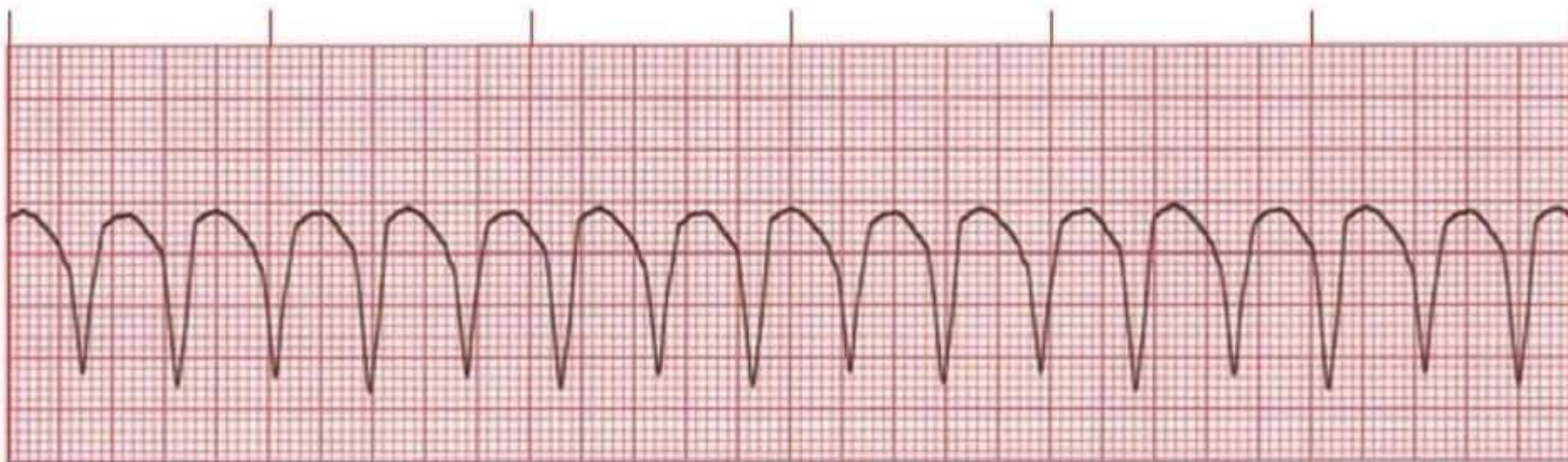
♥ **Clinical Tip:** It is important to confirm the presence or absence of pulses because polymorphic VT may be perfusing or nonperfusing.

♥ **Clinical Tip:** Consider electrolyte abnormalities as a possible etiology.



Ventricular Tachycardia (VT): Monomorphic

- QRS complexes in monomorphic VT have the same shape and amplitude.



Rate: 100–250 bpm

Rhythm: Regular

P Waves: None or not associated with the QRS

PR Interval: None

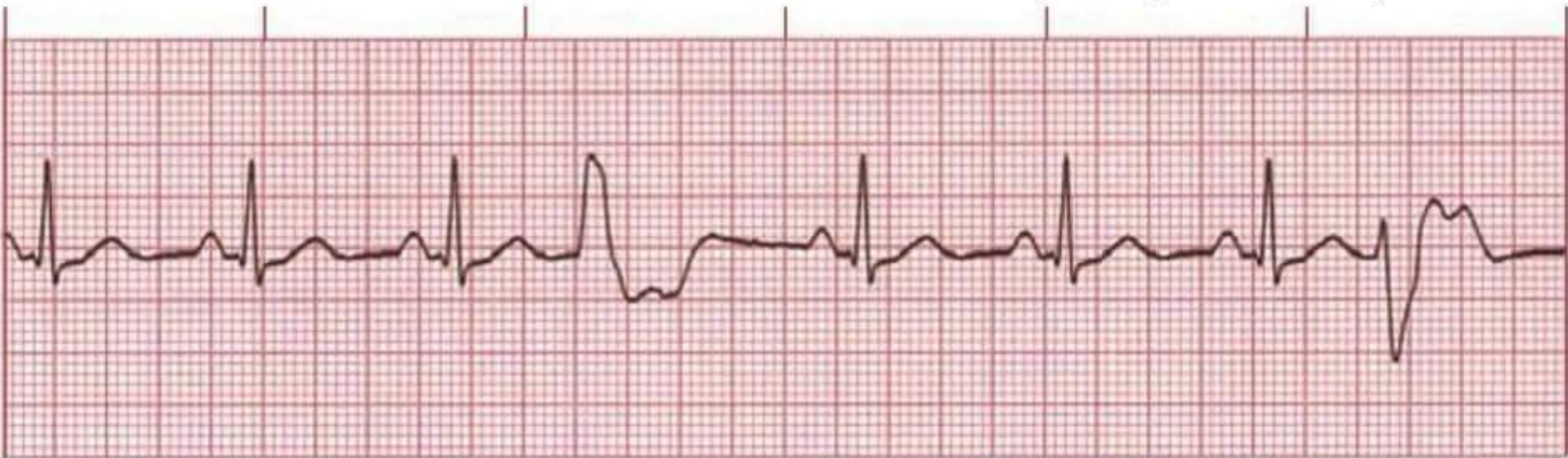
QRS: Wide (>0.10 sec), bizarre appearance

♥ **Clinical Tip:** It is important to confirm the presence or absence of pulses because monomorphic VT may be perfusing or nonperfusing.

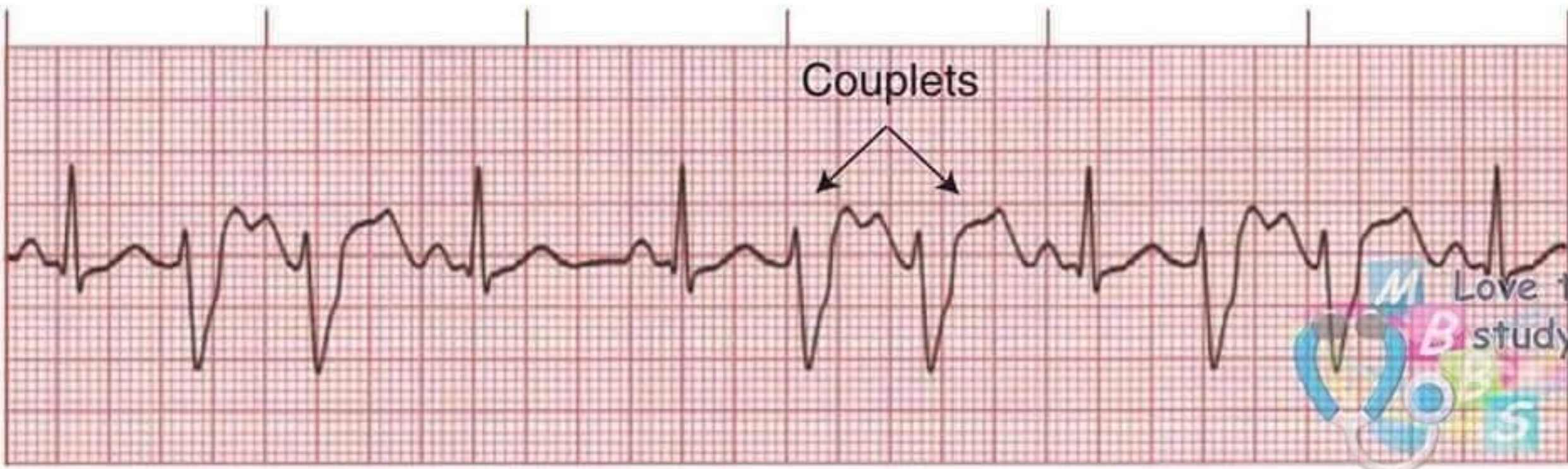
♥ **Clinical Tip:** Monomorphic VT will probably deteriorate into VF or unstable VT if sustained and not treated.



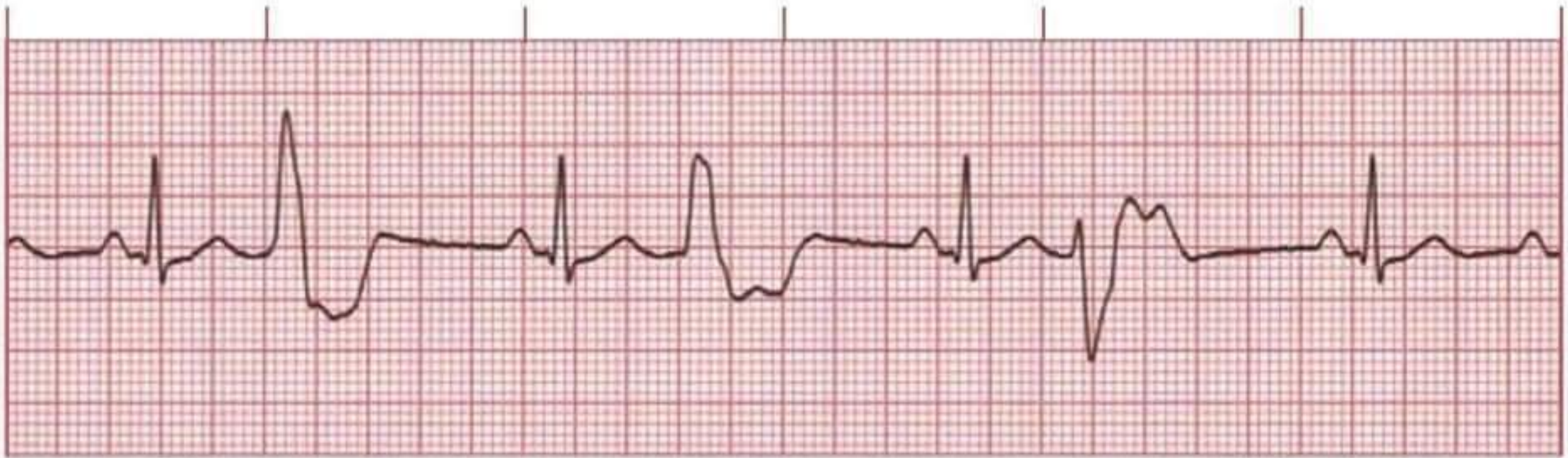
Premature Ventricular Contraction: Ventricular Quadrigeminy (PVC every 4th beat)



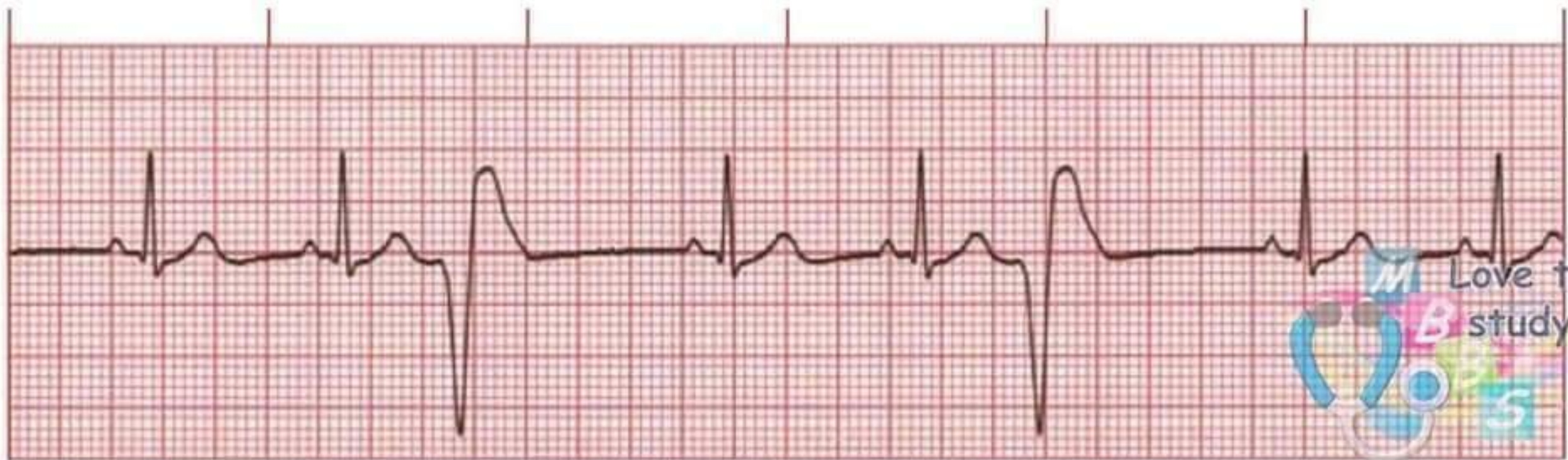
Premature Ventricular Contraction: Couplets (paired PVCs)



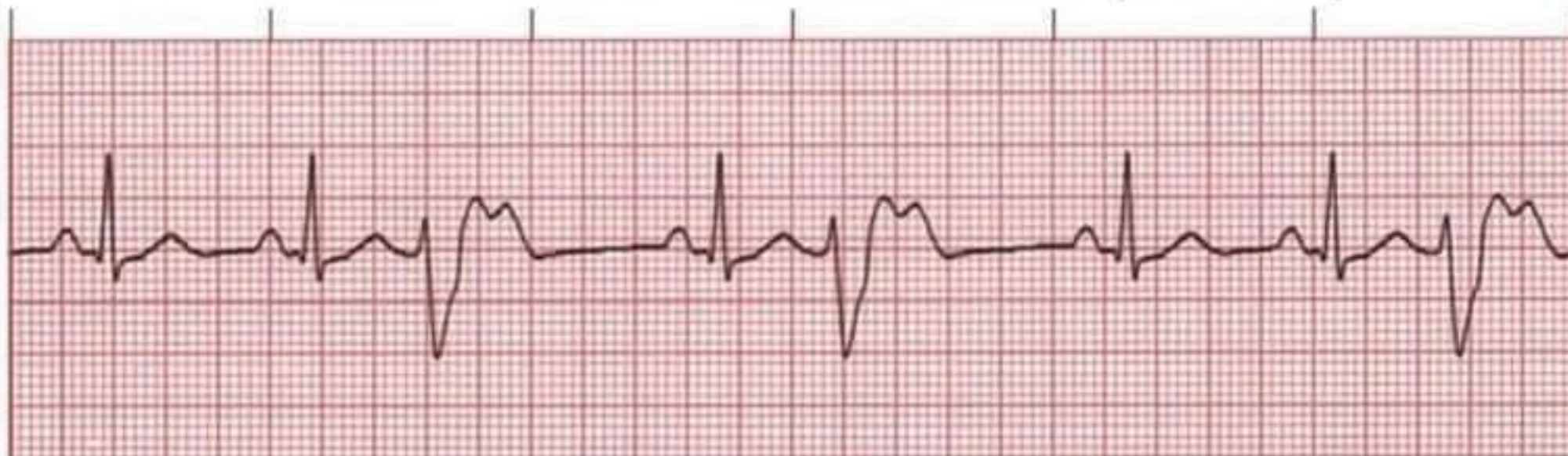
Premature Ventricular Contraction: Ventricular Bigeminy (PVC every other beat)



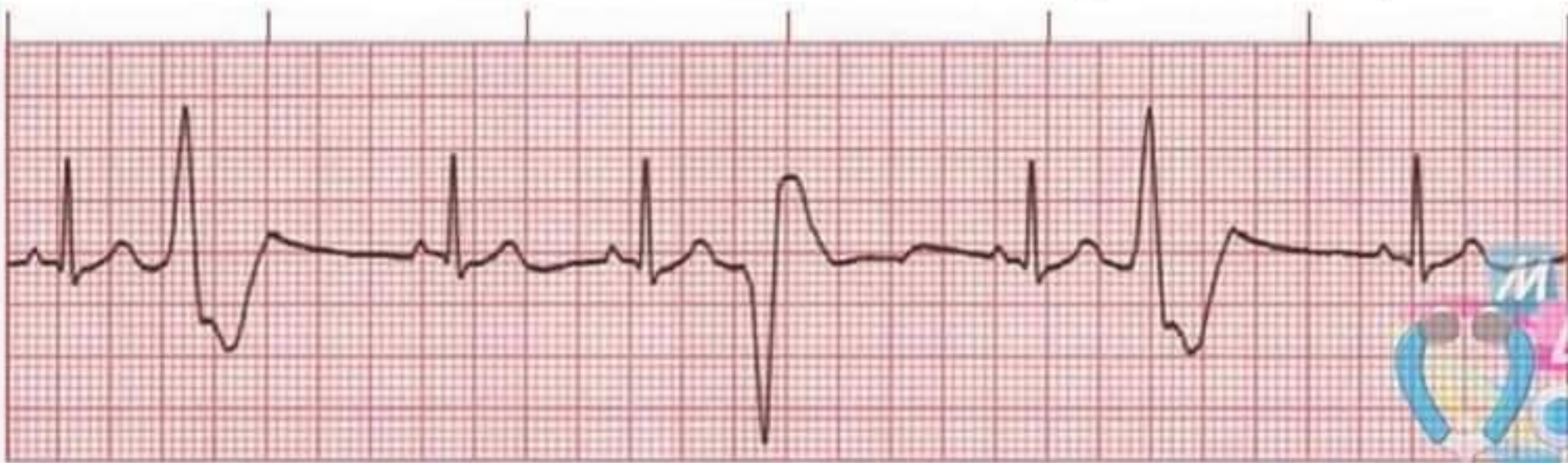
Premature Ventricular Contraction: Ventricular Trigeminy (PVC every 3rd beat)



Premature Ventricular Contraction: Uniform (same form)

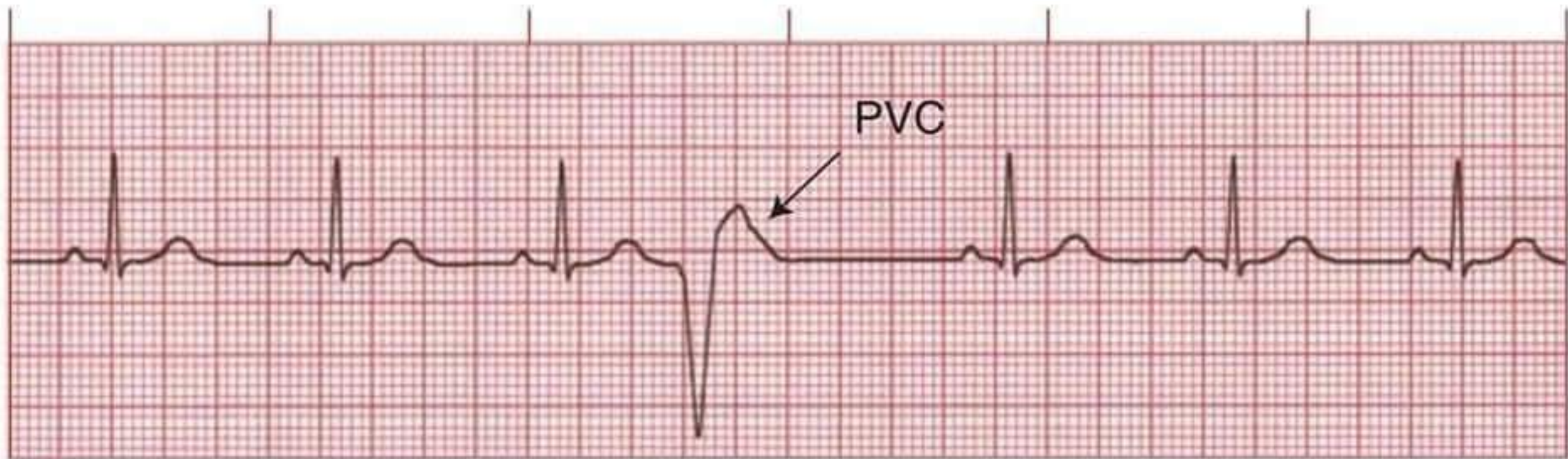


Premature Ventricular Contraction: Multiform (different forms)



Premature Ventricular Contraction (PVC)

- Usually PVCs result from an irritable ventricular focus.
- PVCs may be uniform (same form) or multiform (different forms).
- The pause following a PVC may be compensatory or noncompensatory.



Rate: Depends on rate of underlying rhythm

Rhythm: Irregular whenever a PVC occurs

P Waves: None associated with the PVC

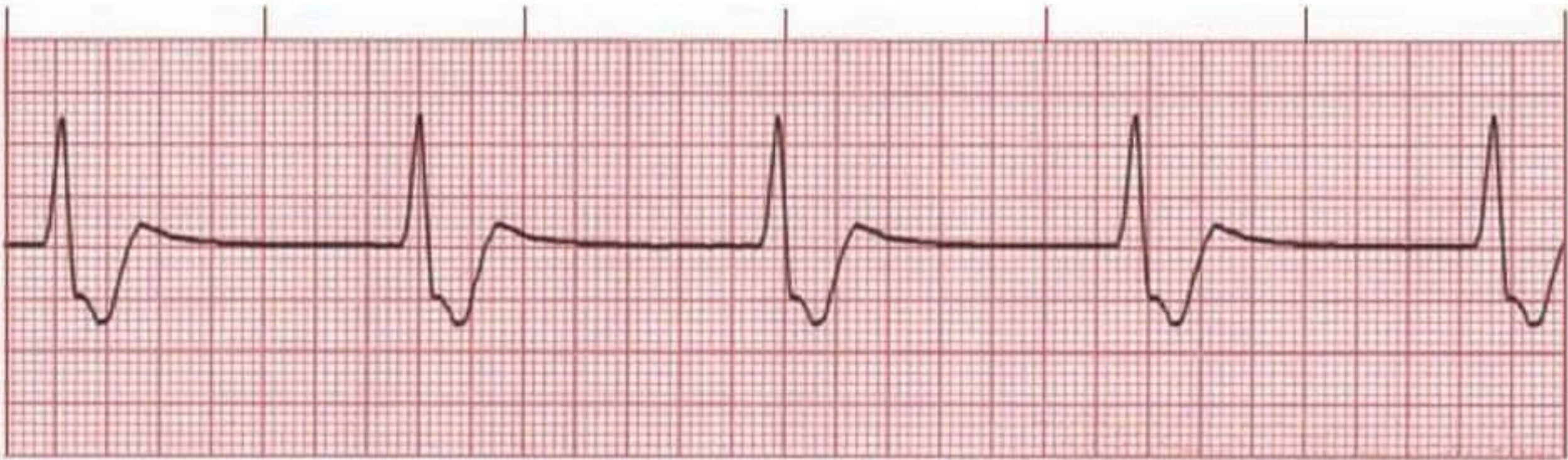
PR Interval: None associated with the PVC

QRS: Wide (>0.10 sec), bizarre appearance

♥ **Clinical Tip:** Patients may sense the occurrence of PVCs as skipped beats. Because the ventricles are only partially filled, the PVC frequently does not generate a pulse.



Accelerated Idioventricular Rhythm



Rate: 41–100 bpm

Rhythm: Regular

P Waves: None

PR Interval: None

QRS: Wide (>0.10 sec), bizarre appearance

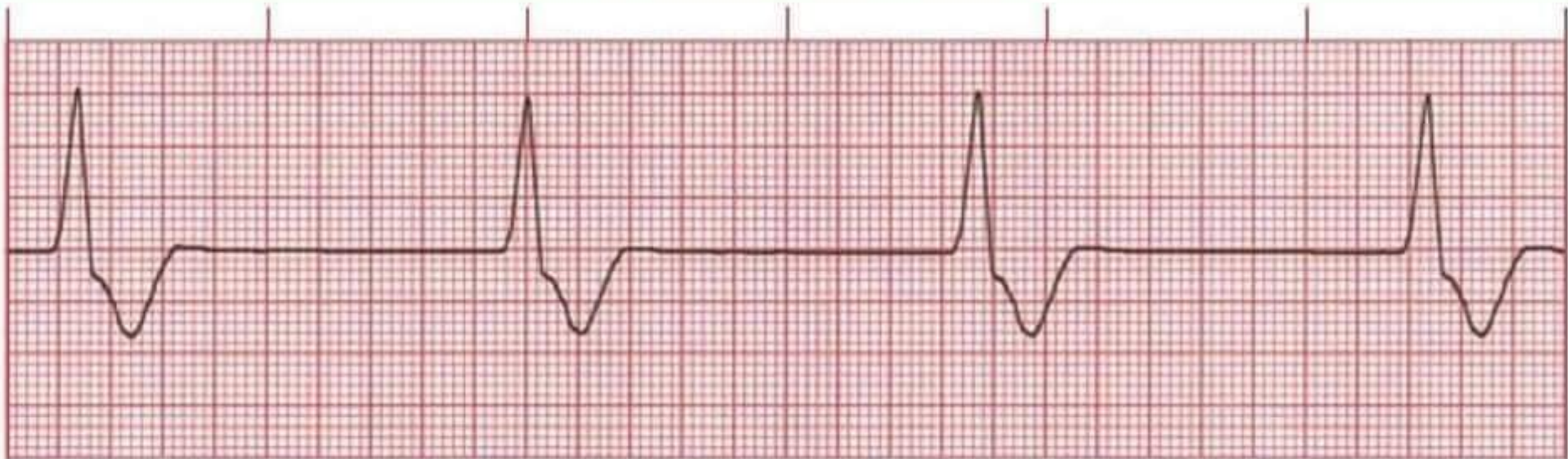
♥ **Clinical Tip:** Idioventricular rhythms appear when supraventricular pacing sites are depressed or absent. Diminished cardiac output is expected if the heart rate is slow.



Ventricular Arrhythmias

- QRS complex is >0.10 sec. P Waves are absent or, if visible, have no consistent relationship to the QRS complex.

Idioventricular Rhythm



Rate: 20–40 bpm

Rhythm: Regular

P Waves: None

PR Interval: None

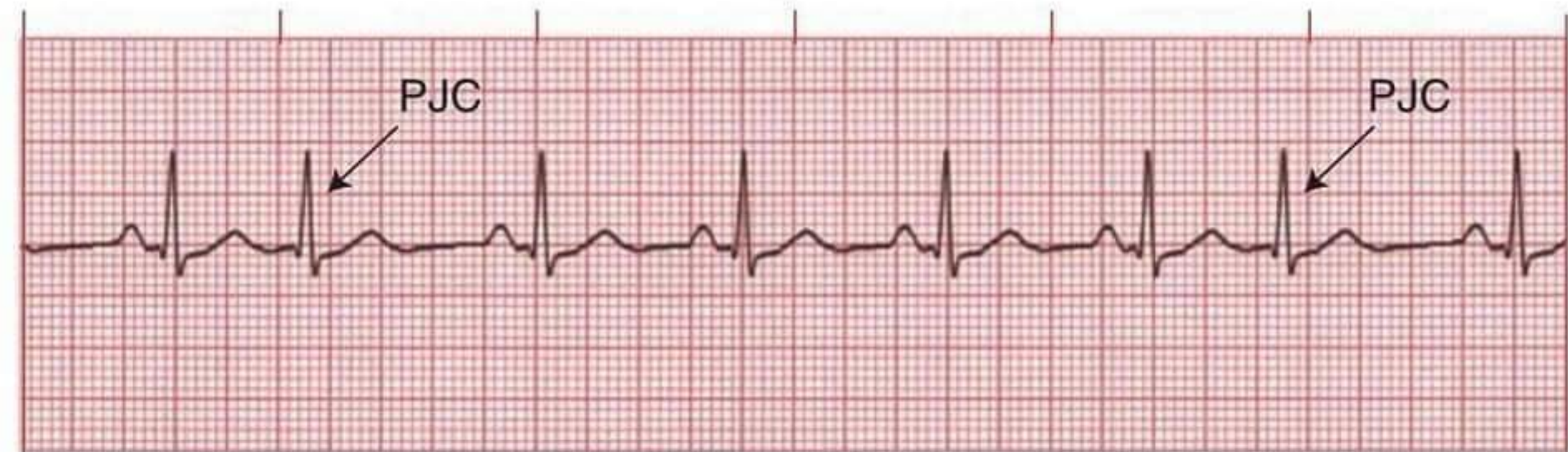
QRS: Wide (>0.10 sec), bizarre appearance

♥ **Clinical Tip:** Idioventricular rhythm may also be called agonal rhythm.



Premature Junctional Contraction (PJC)

■ Enhanced automaticity in the AV junction produces PJCs.



Rate: Depends on rate of underlying rhythm

Rhythm: Irregular whenever a PJC occurs

P Waves: Absent, inverted, buried, or retrograde in the PJC

PR Interval: None, short, or retrograde

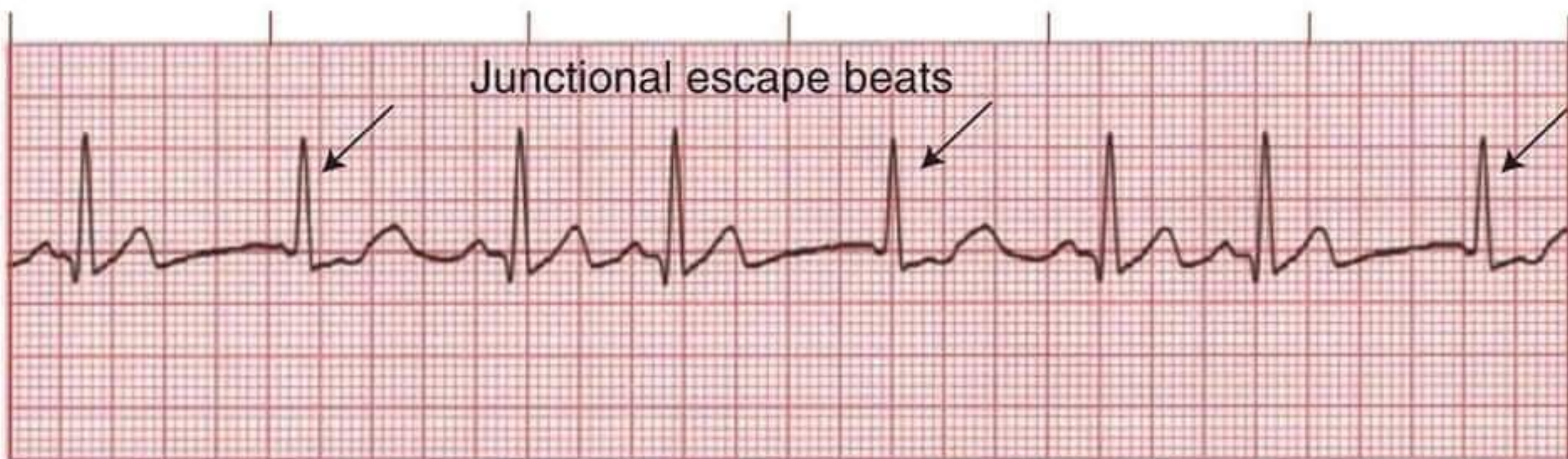
QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Before deciding that isolated PJCs may be insignificant, consider the cause.



Junctional Escape Beat

- An escape complex comes later than the next expected sinus complex.



Rate: Depends on rate of underlying rhythm

Rhythm: Irregular whenever an escape beat occurs

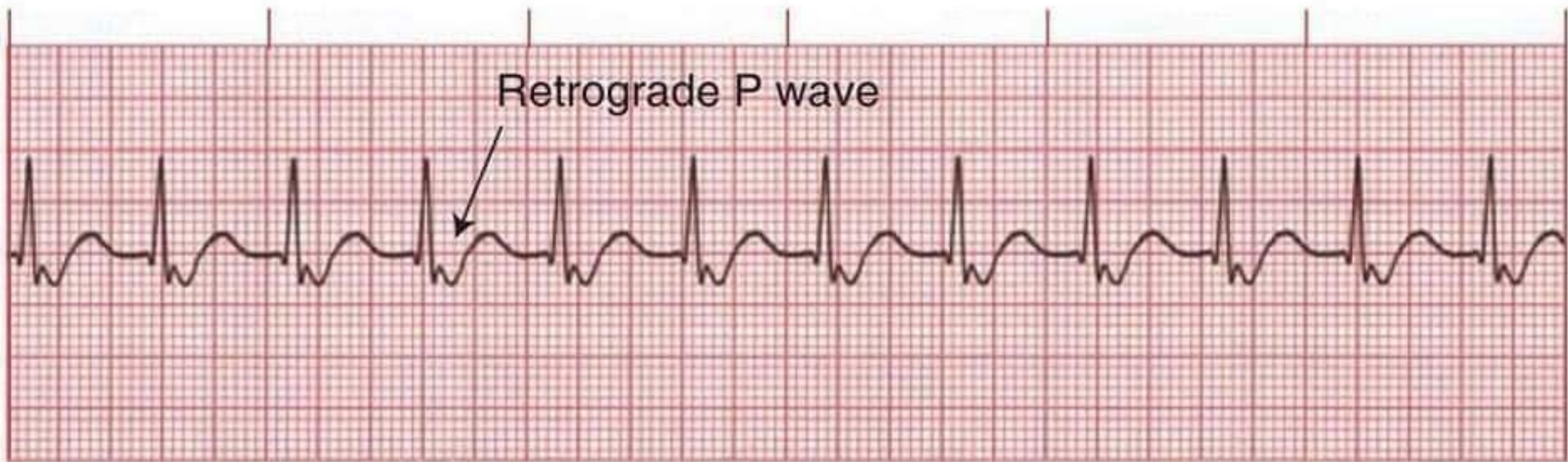
P Waves: None, inverted, buried, or retrograde in the escape beat

PR Interval: None, short, or retrograde

QRS: Normal (0.06–0.10 sec)



Junctional Tachycardia



Rate: 101–180 bpm

Rhythm: Regular

P Waves: Absent, inverted, buried, or retrograde

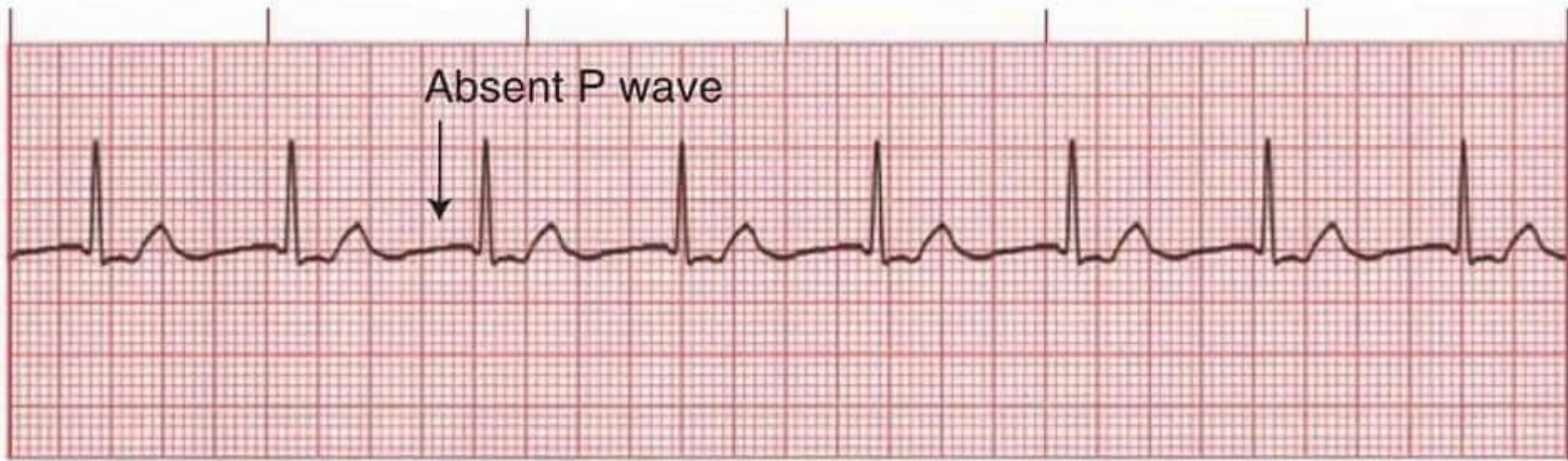
PR Interval: None, short, or retrograde

QRS: Normal (0.06–0.10 sec)

♥ **Clinical Tip:** Signs and symptoms of decreased cardiac output may be seen in response to the rapid rate.



Accelerated Junctional Rhythm



Rate: 61–100 bpm

Rhythm: Regular

P Waves: Absent, inverted, buried, or retrograde

PR Interval: None, short, or retrograde

QRS: Normal (0.06–0.10 sec)

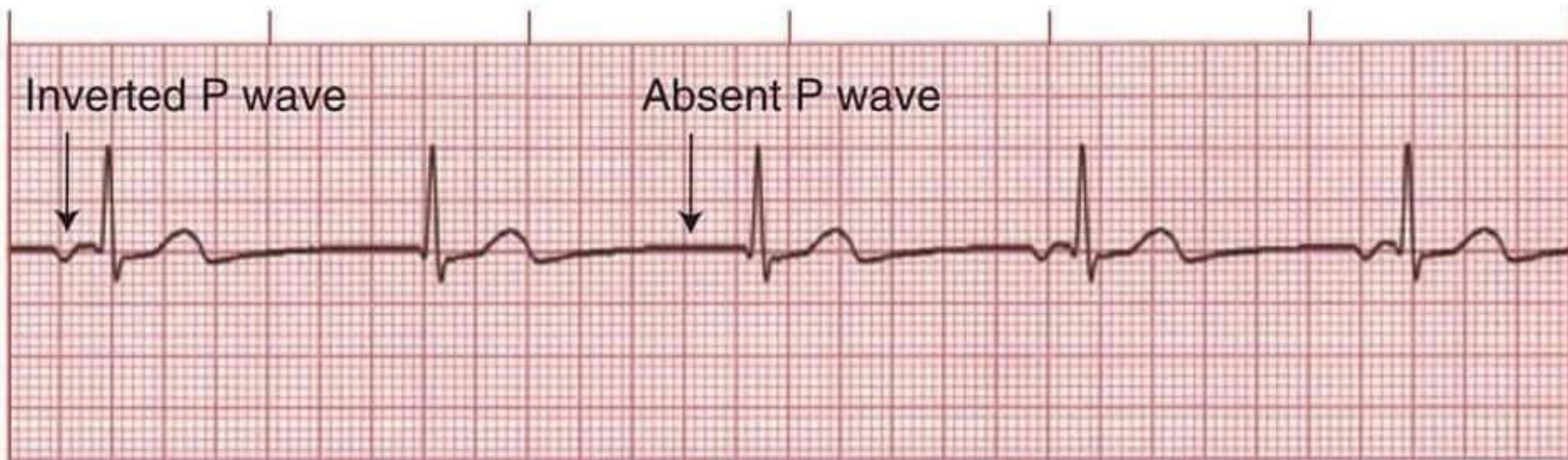
♥ **Clinical Tip:** Monitor the patient, not just the ECG, for clinical improvement.



Junctional Arrhythmias

- The atria and SA node do not perform their normal pacemaking functions.
- A junctional escape rhythm begins.

Junctional Rhythm



Rate: 40–60 bpm

Rhythm: Regular

P Waves: Absent, inverted, buried, or retrograde

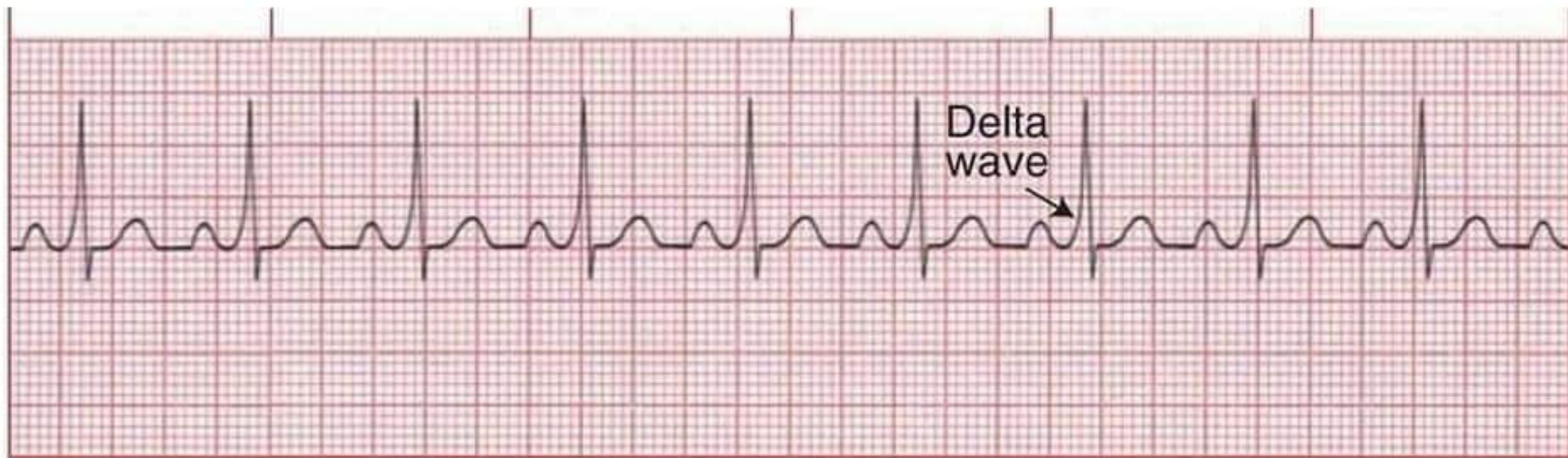
PR Interval: None, short, or retrograde

QRS: Normal (0.06–0.10 sec)



Wolff-Parkinson-White (WPW) Syndrome

- In WPW an accessory conduction pathway is present between the atria and the ventricles. Electrical impulses are rapidly conducted to the ventricles.
- These rapid impulses create a slurring of the initial portion of the QRS called the delta wave.



Rate: Depends on rate of underlying rhythm

Rhythm: Regular unless associated with A-fib

P Waves: Normal (upright and uniform) unless A-fib is present

PR Interval: Short (<0.12 sec) if P wave is present

QRS: Wide (>0.10 sec); delta wave present

♥ **Clinical Tip:** WPW is associated with narrow-complex tachycardias, including A-flutter and A-fib.

