MEDAVIE HealthEd ÉduSanté

Rhythm Interpretation

Part A: Atrial

Primary Care Paramedicine

Module: 12

Section: 04a

Normal Sinus Rhythm

Rate	60 – 100 bpm
Rhythm	Regular
P Waves	Upright, 1 per QRS
PRI	0.12 – 0.20 s (120 – 200 ms)
QRS	<0.12 s (<120 ms), narrow

Dysrhythmias Originating in the SA Node

- Sinus Bradycardia
- Sinus Tachycardia
- Sinus Dysrhythmia
- Sinus Arrest

Sinus Bradycardia

Rate	< 60 bpm
Rhythm	Regular
P Waves	Upright, 1 per QRS
PRI	0.12 – 0.20 s (120 – 200 ms)
QRS	<0.12 s (<120 ms), narrow

Sinus Bradycardia

Etiology

- Increased parasympathetic (vagal) tone, intrinsic disease of the SA node, drug effects
- May be a normal finding in healthy, well-conditioned persons

Clinical Significance

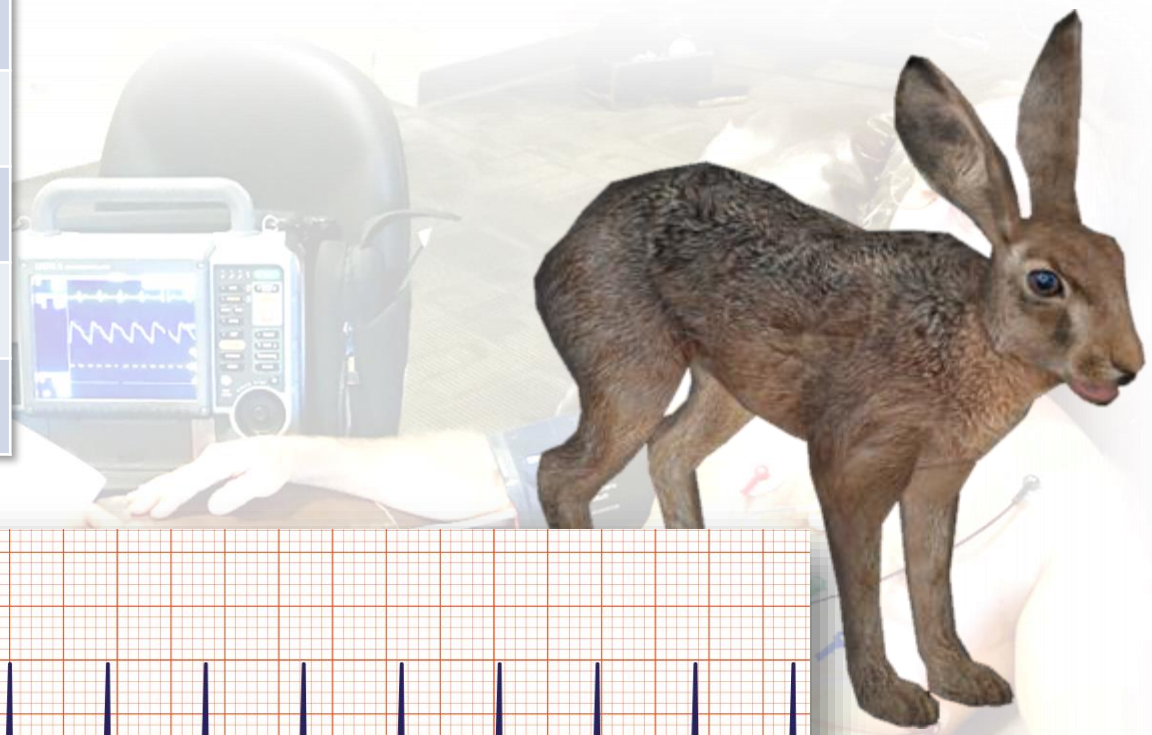
- May result in decreased cardiac output, hypotension, angina, or CNS symptoms
- In healthy, well-conditioned person, may have no significance

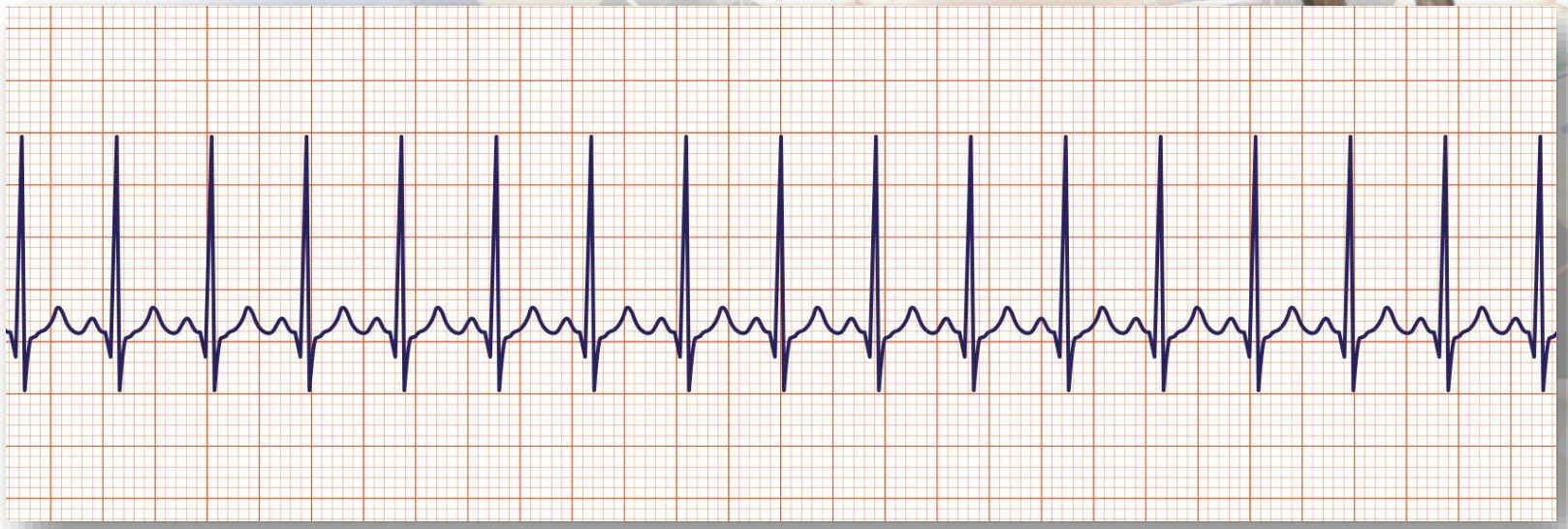
Treatment

- Generally unnecessary unless hypotension or ventricular irritability is present

Sinus Tachycardia

Rate	> 100 bpm
Rhythm	Regular
P Waves	Upright, 1 per QRS
PRI	0.12 – 0.20 s (120 – 200 ms)
QRS	<0.12 s (<120 ms), narrow





Sinus Tachycardia

Etiology

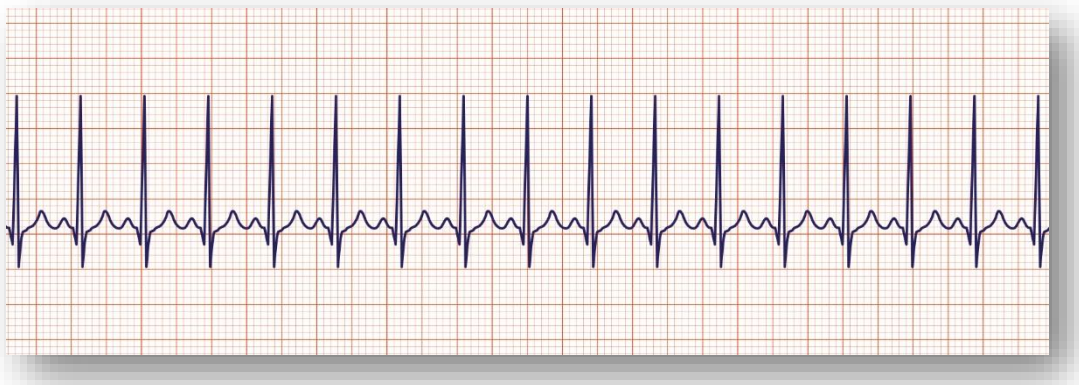
- Results from an increased rate of SA node discharge.
- Potential causes include exercise, fever, anxiety, hypovolemia, anemia, pump failure, increased sympathetic tone, hypoxia, or hypothyroidism

Clinical Significance

- Decreased cardiac output for rates >140
- Very rapid rates can precipitate ischemia or infarct

Treatment

- Treatment is directed at the underlying cause



Sinus Dysrhythmia

Rate	60 - 100 bpm
Rhythm	Irregular
P Waves	Upright, 1 per QRS
PRI	0.12 – 0.20 s (120 – 200 ms)
QRS	<0.12 s (<120 ms), narrow

Sinus Dysrhythmia

Etiology

- Slight variation of a sinus rhythm
- Bainbridge reflex
- Increases SV and blood pressure
- Normal finding in children and young adults

Clinical Significance

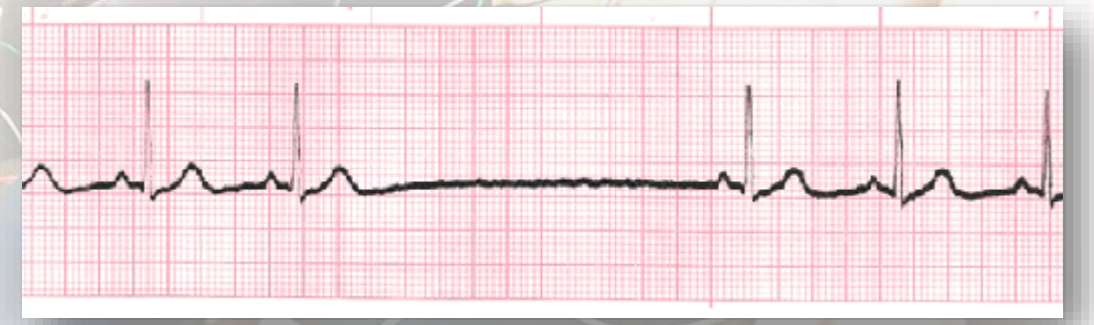
- Normal variant

Treatment

- Typically, none required

Sinus Arrest

Rate	Slow to Normal
Rhythm	Irregular
P Waves	Upright, 1 per QRS
PRI	0.12 – 0.20 s (120 – 200 ms)
QRS	<0.12 s (<120 ms), narrow



Sinus Arrest

Etiology

- SA node fails to initiate an impulse.
- SA node resumes normal functioning.
- May result from ischemia of the SA node, digitalis toxicity, excessive vagal tone, or degenerative fibrotic disease

Clinical Significance

- Occasional episodes are not significant.
- Frequent or prolonged episodes may decrease cardiac output and cause syncope
- Prolonged episodes may result in escape rhythms

Treatment

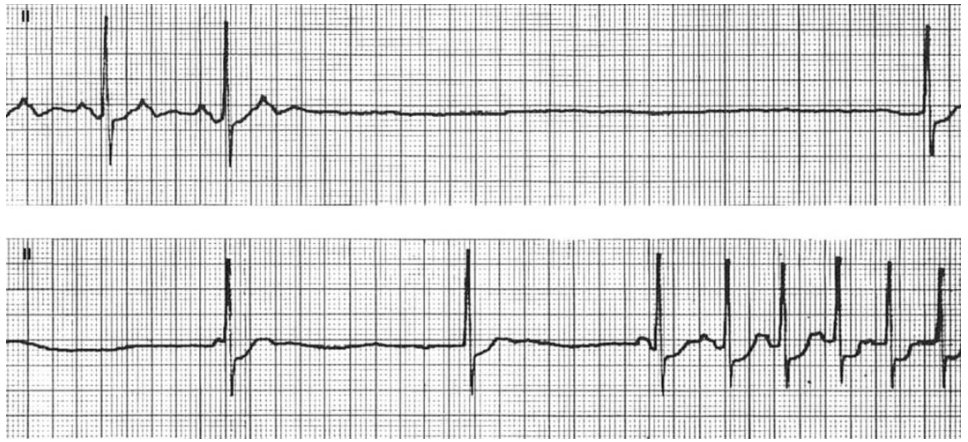
- Treatment based on the overall HR and tolerance
  - None if patient is asymptomatic
  - Treat symptomatic bradycardia

Sick Sinus Syndrome

- Encompasses a variety of rhythms that involve a poorly functioning SA node and is common in older patients
- Announces itself in many ways
- Patients may remain asymptomatic or they may experience a syncopal or near-syncopal episode, dizziness, and palpitations.

Sick Sinus Syndrome

- Bradycardia-tachycardia syndrome
  - Symptomatic vs asymptomatic depends on how tachy/brady the patient becomes
  - May include:
    - Chest pain or palpitations
    - Confusion or other changes in mental status
    - Fainting or near-fainting, fatigue
    - Shortness of breath



Rhythms of the Atria

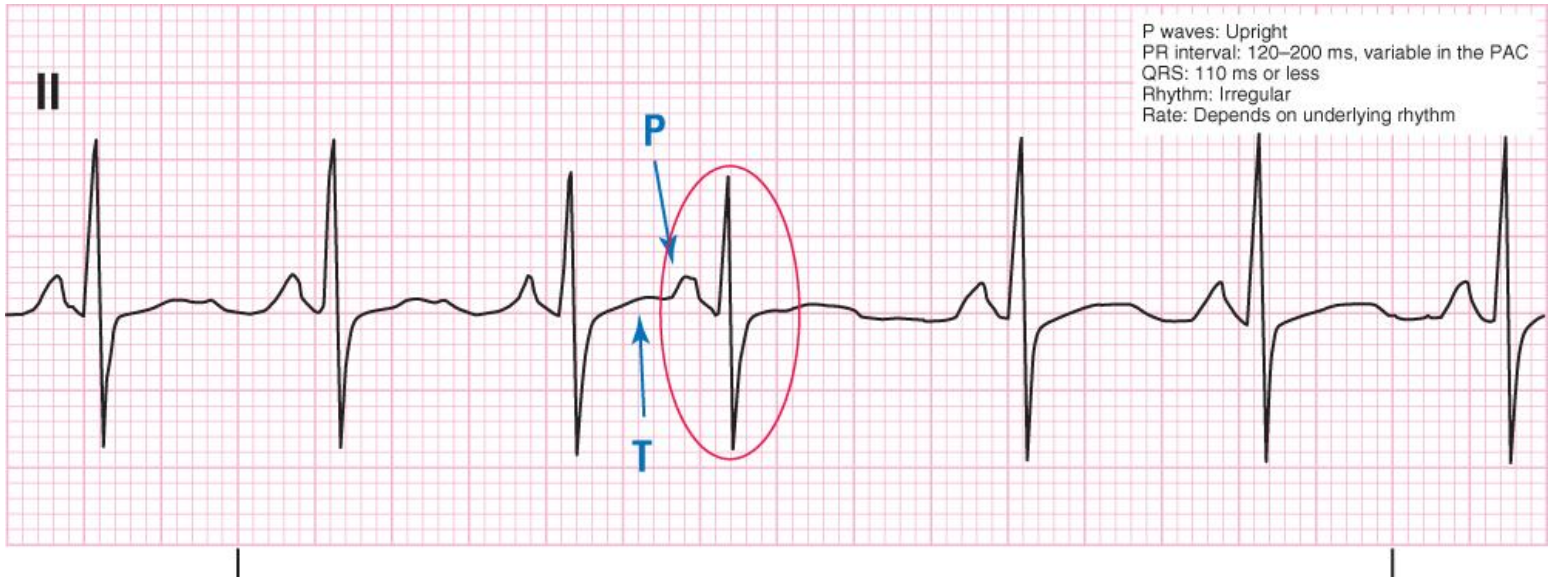
- Atrial rhythms
  - Any area of the atria may originate an impulse.
  - Some rhythms originating from the atria produce upright P waves that precede each QRS complex, but they are not as well rounded as those generated by the SA node.

Wandering Atrial Pacemaker

- Pacemaker moves from the SA node to various areas within the atria or AV junction.
- Rhythm is slightly irregular.
- Most often seen in children, older adults, and athletes
- Treatment is usually not indicated in the prehospital setting.

Premature Atrial Complex (PAC)

- Not a dysrhythmia
- An ectopic complex that appears within another rhythm
- Occurs earlier than the next expected sinus complex
- When frequent, treatment is focused on correcting underlying cause.



Supraventricular Tachycardia

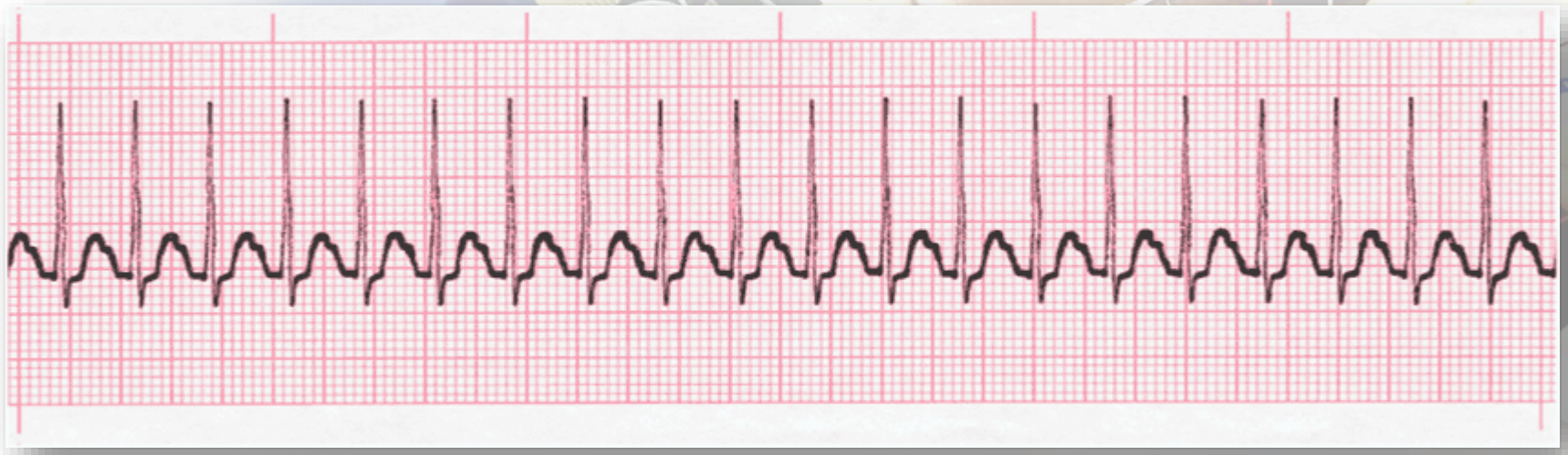
- SVT is the name given to any extreme tachycardia that originates above the ventricles (specifically above the bundle of His)
- High rate of QRS complexes can make it difficult to determine whether P waves are present
- Narrow width QRS complexes confirm supraventricular origin
- Rhythm can be regular or irregular

Supraventricular Tachycardia

- Although SVT is a general name for a group of tachycardias, when a patient experiences SVT in an abrupt onset/offset pattern it is referred to as Paroxysmal Supraventricular Tachycardia (pSVT)
  - Typically this is the result of re-entry

Supraventricular Tachycardia

Rate	> 150 bpm
Rhythm	Regular (usually)
P Waves	Typically hidden
PRI	0.12 – 0.20 s (120 – 200 ms)
QRS	<0.12 s (<120 ms), narrow



Supraventricular Tachycardia

Etiology

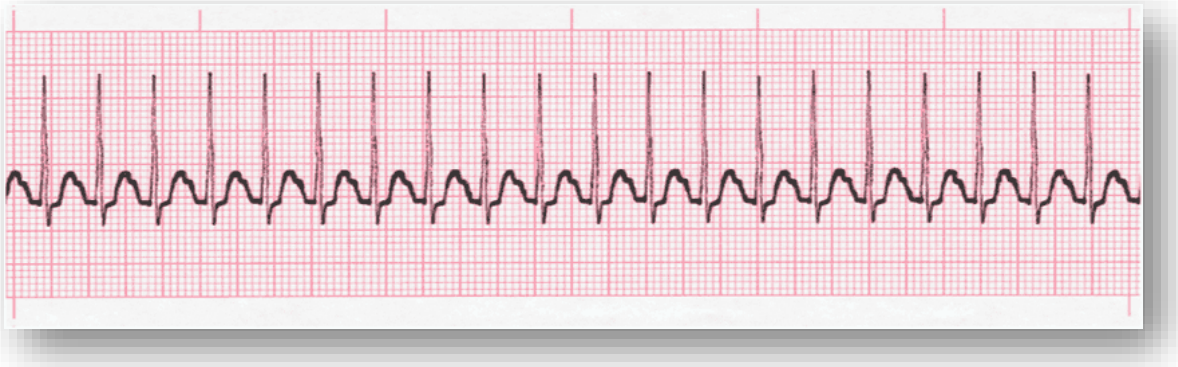
- Rapid atrial depolarization overrides the SA node
- May be precipitated by stress, overexertion, smoking, caffeine

Clinical Significance

- May be tolerated well by healthy patients for short periods
- Marked reduction in cardiac output can precipitate angina, hypotension, or congestive heart failure

Treatment

- PCP Treatment
  - Symptomatic
- ACP Treatment
  - Vagal Maneuvers
  - Pharm: Adenosine
  - Electrical: Synchronized cardioversion



Atrial Flutter

Rate	• Atrial rate 200-400 • Ventricular rate varies
Rhythm	Regular (usually)
P Waves	Flutter waves are present
PRI	0.12 – 0.20 s (120 – 200 ms)
QRS	When conducted <0.12 s (<120 ms), narrow

Atrial Flutter

Etiology

- Atrial impulse fires at a rate too rapid for the ventricles to keep up.
- Known as **flutter** or **F waves**
- Impulses may be conducted in fixed or variable ratios. (Ex. 2:1, 3:1, 4:1)

Clinical Significance

- Usually a sign of a serious heart problem
- Generally well tolerated
- Rapid ventricular rates may compromise cardiac output and result in symptoms
- Degenerates into atrial fibrillation

Treatment

- PCP Treatment
  - Symptomatic
- ACP Treatment
  - Pharm: Rate control
  - Electrical: Synchronized cardioversion

Atrial Fibrillation

Rate	• Atrial rate 400-600 (though not discernible) • Ventricular rate varies
Rhythm	Irregularly irregular
P Waves	None discernible
PRI	None discernible
QRS	<0.12 s (<120 ms), narrow

Atrial Fibrillation

- With AF, due to such a high atrial rate, no discernable P waves are present
- Depending on conduction of impulses through to the ventricles, ventricular rate is irregular and can vary
  - When ventricular rate is tachycardic = AF with rapid ventricular response

Atrial Fibrillation

Etiology

- Results from multiple ectopic foci; AV conduction is random and highly variable
- Often associated with underlying heart disease, metabolic disturbances and toxicological emergencies

Clinical Significance

- Atria fail to contract effectively, reducing cardiac output
- Well tolerated when ventricular rates are normal
- High or low ventricular rates can result in cardiac compromise
- Most common sustained dysrhythmia

Treatment

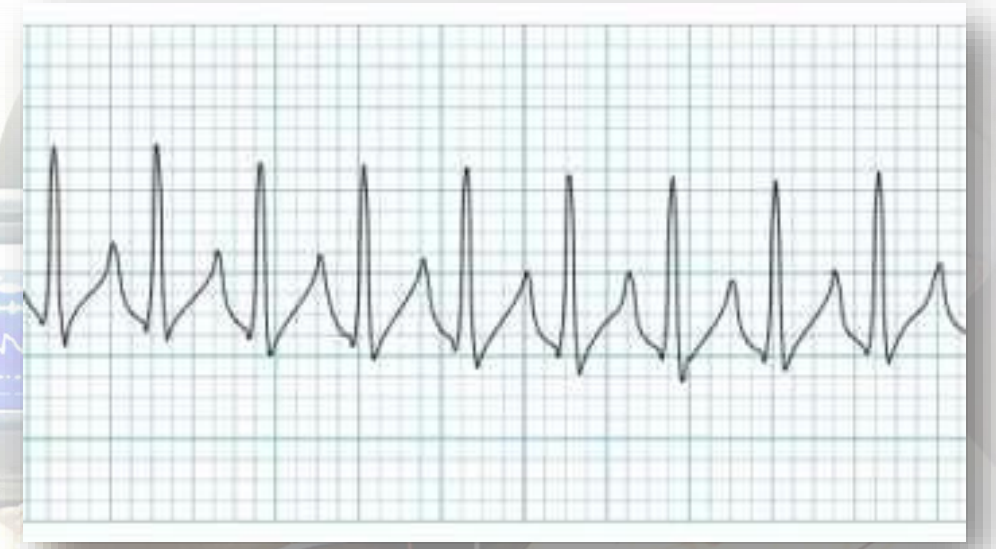
- PCP Treatment
  - limited to supportive care.
- ACP Treatment
  - Pharm: Rate control
  - Electrical: Synchronized cardioversion

Atrial Fibrillation

- With AF, due to such a high atrial rate, no discernable P waves are present
- Depending on conduction of impulses through to the ventricles, ventricular rate is irregular and can vary
  - When ventricular rate is tachycardic = AF with rapid ventricular response

Multifocal Atrial Tachycardia

Rate	> 100 bpm
Rhythm	Irregular
P Waves	Organized, nonsinus P waves; at least 3 forms
PRI	Varies depending on source of impulse
QRS	Variable



Multifocal Atrial Tachycardia

Etiology

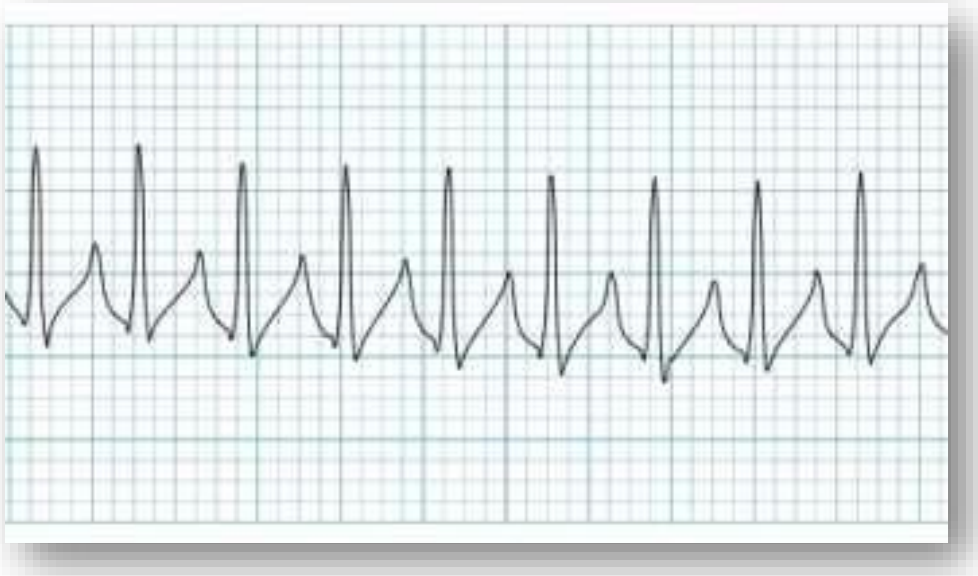
- Multiple ectopic sites within the atria depolarize at different but rapid rates.
- Often seen in acutely ill patients
- Most often seen in patients with significant lung disease (May result from metabolic disorders, ischemic heart disease, or recent surgery)

Clinical Significance

- Presence of multifocal atrial tachycardia often indicates a serious underlying illness

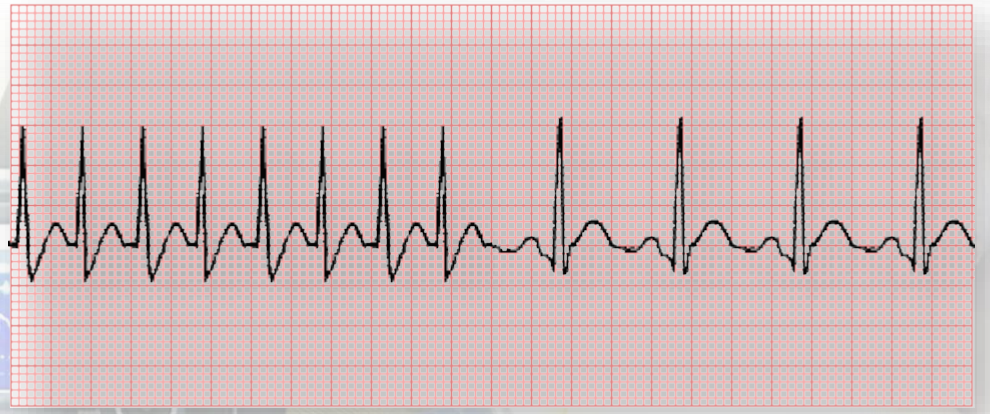
Treatment

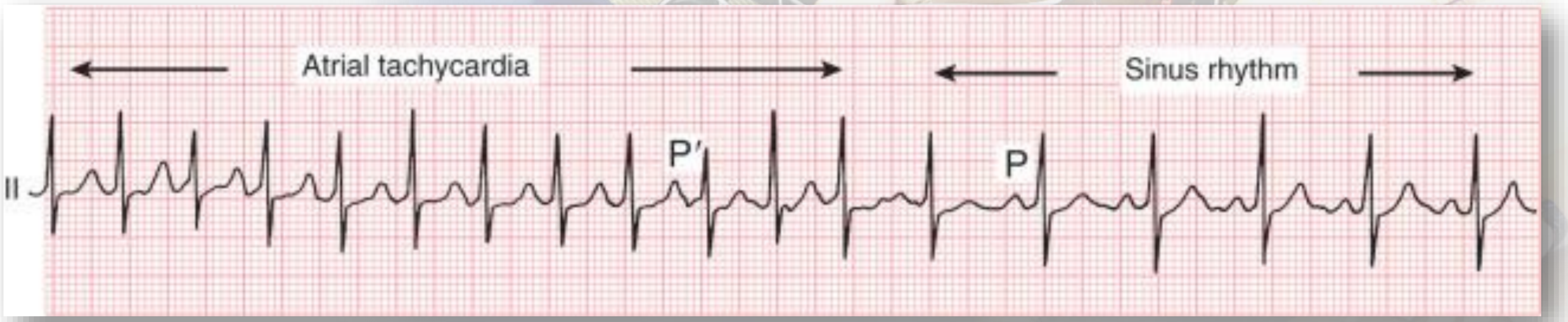
- Treat the underlying illness
- Treat symptoms of tachycardia if present



Atrial Tachycardia

Rate	> 100 bpm
Rhythm	Typically regular
P Waves	Organized, nonsinus P waves
PRI	0.12 – 0.20 s (120 – 200 ms)
QRS	Variable





Atrial Tachycardia

Etiology

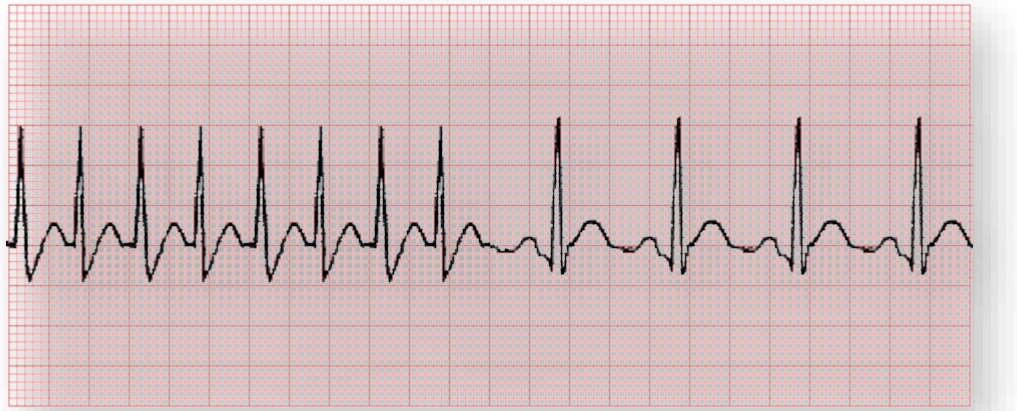
- May result from ischemic heart disease, increase catecholamine release, congenital abnormalities or be idiopathic

Clinical Significance

- Depending on the rate, patient may be symptomatic
- Differs from Sinus Tach as pacemaker site is an ectopic focus rather than SA node

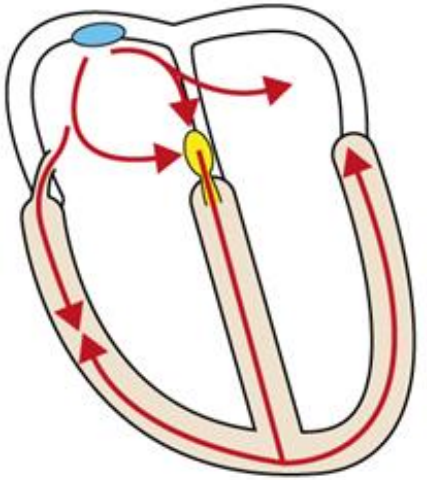
Treatment

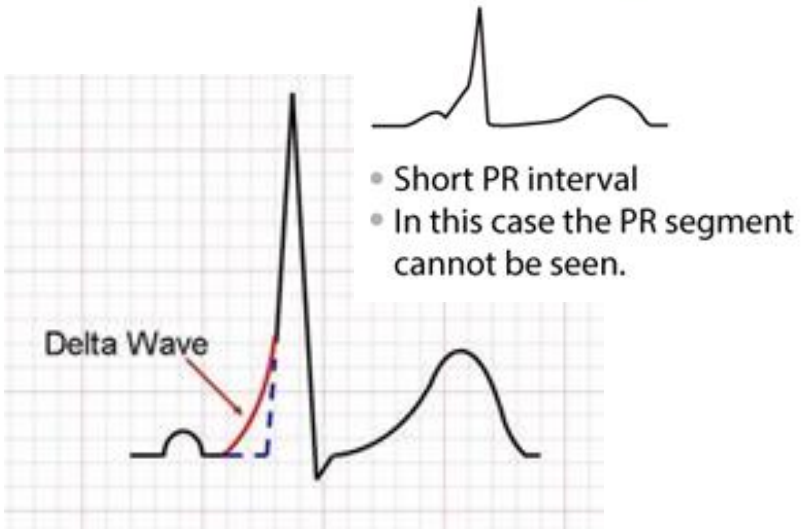
- Treat the underlying illness



Pre-excitation syndromes
Wolff-Parkinson-White (WPW) Syndrome

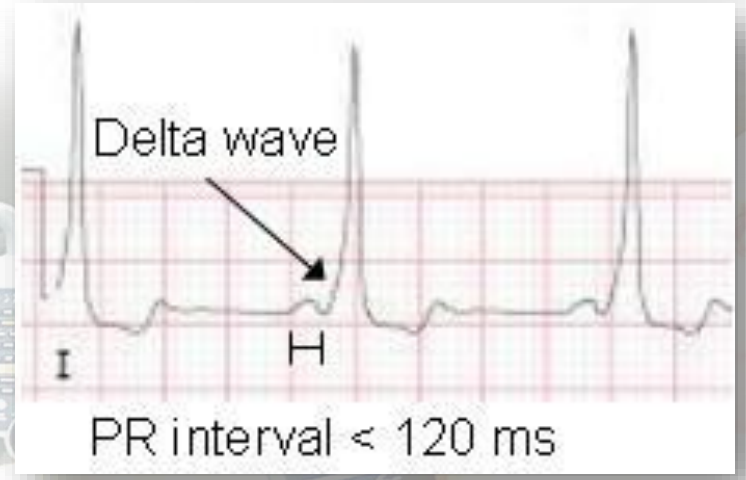
- Presence of a congenital accessory pathway (AP) and episodes of tachyarrhythmias.
- WPW is often used interchangeably with pre-excitation syndrome
- AP known as the Bundle of Kent allows for impulse transmission between atria and ventricles without passage through AV junction
- Signal can be transmitted anterograde and/or retrograde





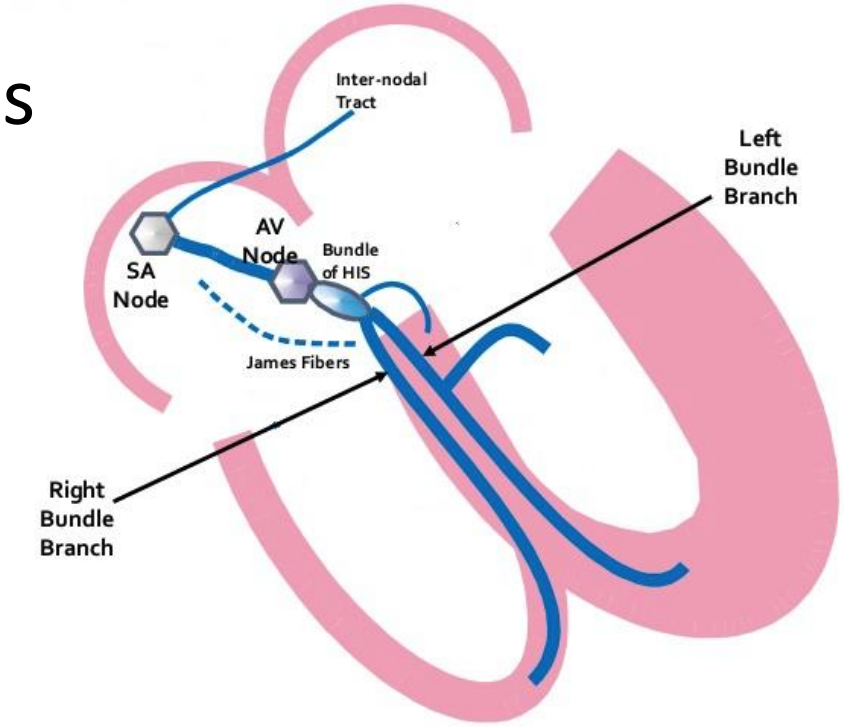
Pre-excitation syndromes
Wolff-Parkinson-White (WPW) Syndrome

Rate	Variable
Rhythm	Regular
P Waves	Present
PRI	< 0.12 s (< 120 ms)
QRS	Prolongation > 0.11 s (110 ms)



Pre-excitation syndromes
Lown-Ganong-Levine Syndrome

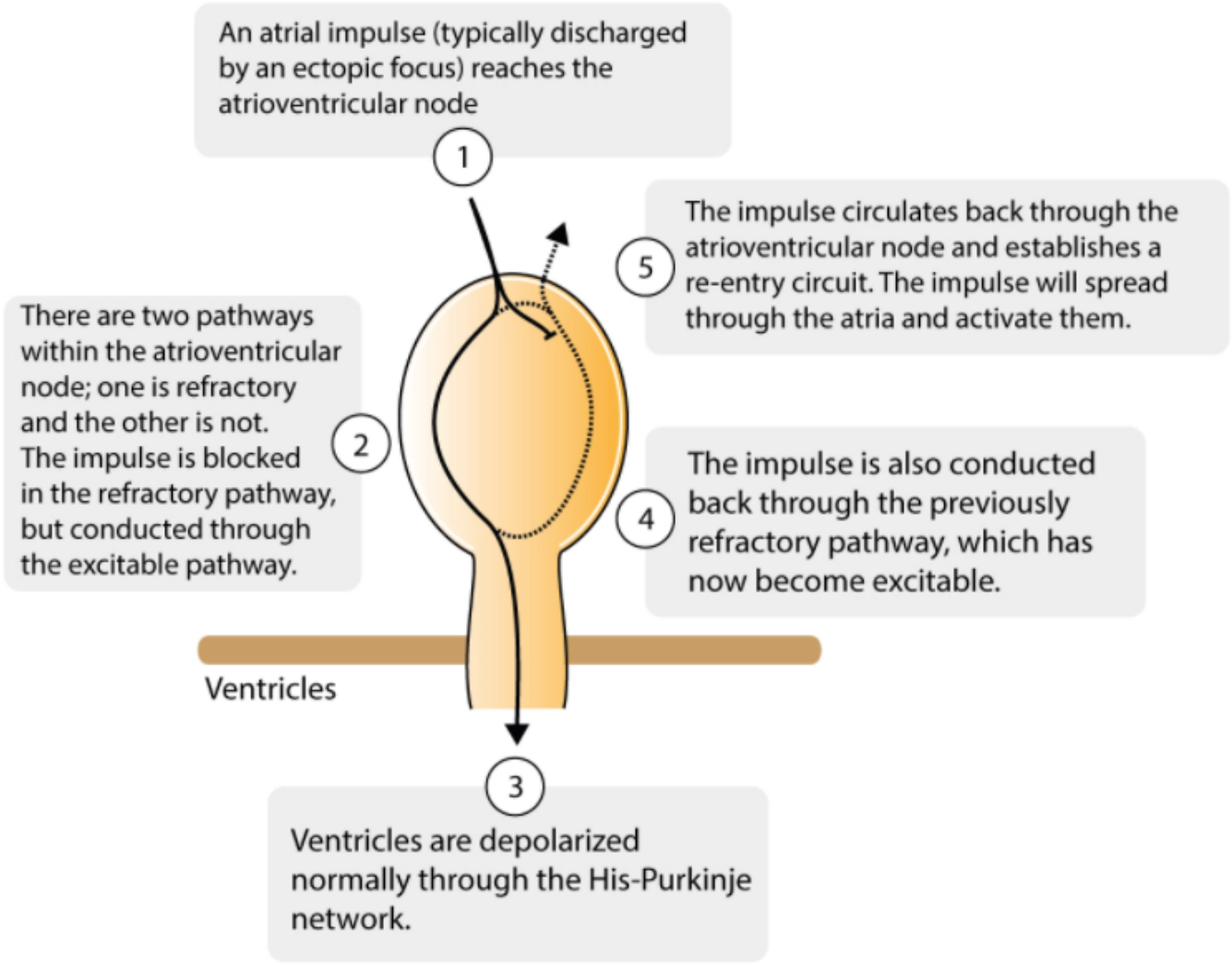
- Due to the presence of accessory pathway known as James Fibers
- Allows for some bypass of AV junction
- Can increase risk of re-entry tachycardias



Reentry

- AV-nodal reentrant tachycardia (AVRNT) and AV reciprocating tachycardia (AVRT)
  - Regular, narrow, complex tachycardias without obvious P waves preceding every complex
  - Often termed PSVT (paroxysmal)
  - AVNRT is the most common
  - AVRT is a similar-appearing tachycardia that results from an accessory pathway.

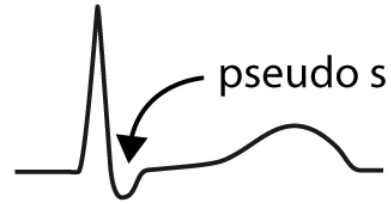
AVRNT

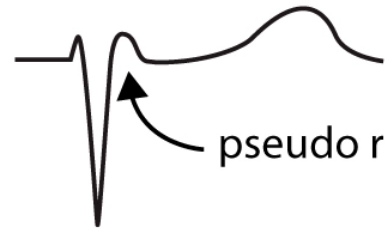

An atrial impulse (typically discharged by an ectopic focus) reaches the atrioventricular node
1
The impulse circulates back through the atrioventricular node and establishes a re-entry circuit. The impulse will spread through the atria and activate them.
5
There are two pathways within the atrioventricular node; one is refractory and the other is not. The impulse is blocked in the refractory pathway, but conducted through the excitable pathway.
2
The impulse is also conducted back through the previously refractory pathway, which has now become excitable.
4
Ventricles
3
Ventricles are depolarized normally through the His-Purkinje network.

AVRNT

Typical AVRNT (slow-fast)
90% of all cases

In most cases the P-wave is hidden in the QRS complex





The P-Wave is sometimes seen after the QRS complex. Presents as a “pseudo s” in lead II and “pseudo r” in V1.

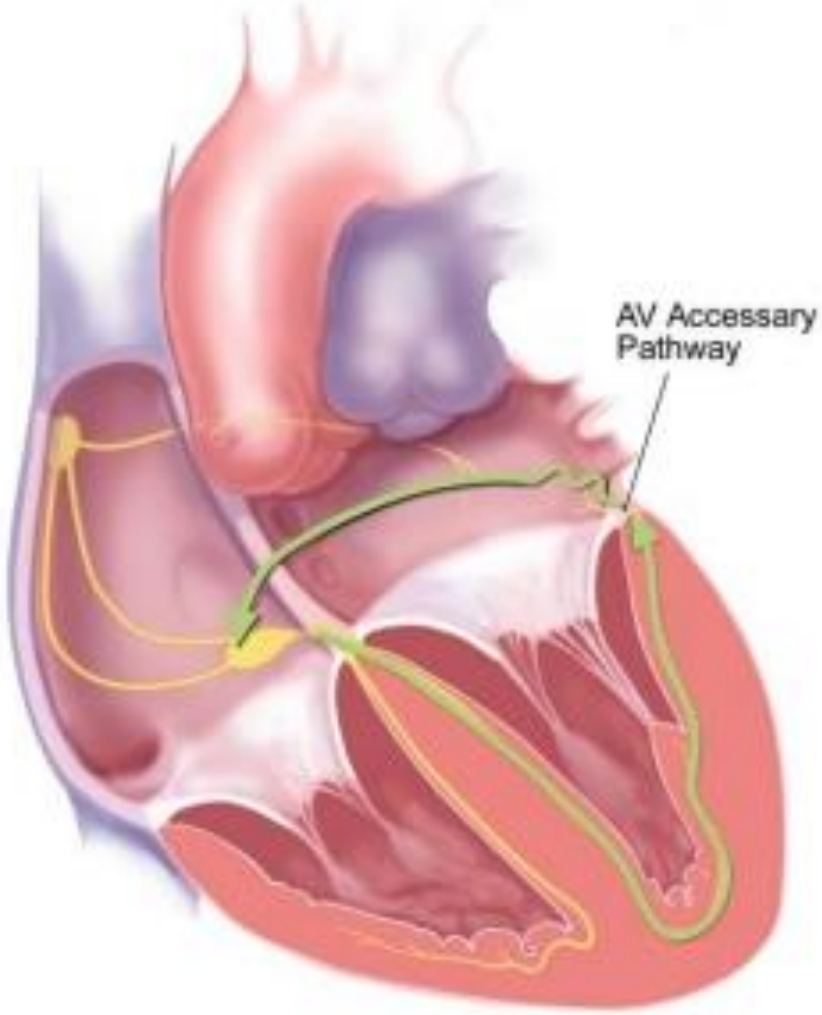
Atypical AVRNT (fast-slow)
10% of all cases

P-wave before QRS

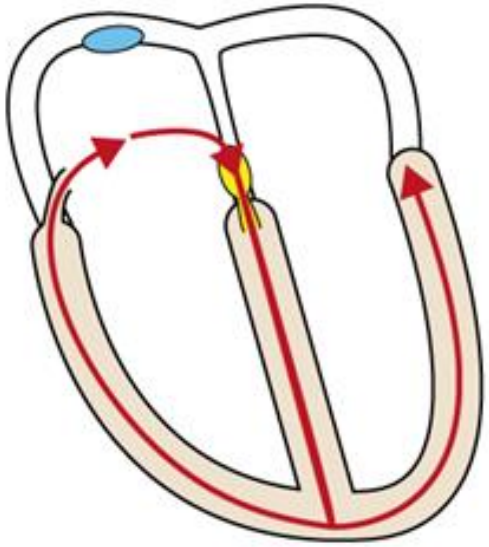
Very Atypical AVRNT (fast-slow)
<1% of all cases

P-wave on ST-T segment

AVRT

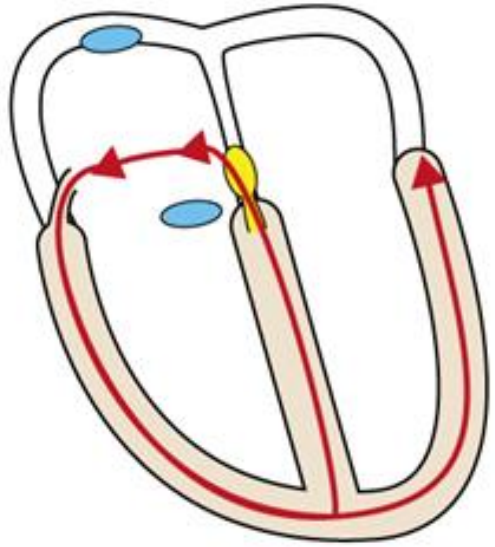


Orthodromic AVRT
Antegrade conduction through atrioventricular node



- Normal QRS duration
- No delta wave
- Retrograde P-wave after QRS

Antidromic AVRT
Retrograde conduction through atrioventricular node



- Wide QRS complex with delta wave
- P-wave rarely seen
- If P-wave visible, it is retrograde and occurs just before the QRS