WPW syndrome and AVRT

Myung-Yong Lee, MD, PhD

Division of Cardiology
Department of Internal Medicine
School of Medicine
Dankook University, Cheonan, Korea
Supraventricular tachycardia (SVT)

An umbrella term used to describe tachycardias (atrial and/or ventricular rates in excess of 100 bpm at rest), the mechanism of which involves tissue from the His bundle or above.

Paroxysmal supraventricular tachycardia (PSVT)

A clinical syndrome characterized by the presence of a regular and rapid tachycardia of abrupt onset and termination. PSVT represents a subset of SVT.

Atrial fibrillation (AF)

Sinus tachycardia
- Physiologic sinus tachycardia
- Inappropriate sinus tachycardia

Atrial tachycardia (AT)
- Focal AT
- Sinus node reentry tachycardia
- Multifocal atrial tachycardia (MAT)

Atrial flutter
- Cavo-tricuspid isthmus-dependent atrial flutter: typical
- Cavo-tricuspid isthmus-dependent atrial flutter: reverse typical
- Atypical or non-cavo-tricuspid isthmus-dependent atrial flutter

Junctional tachycardia

Atrioventricular nodal reentrant tachycardia (AVNRT)
- Typical AVNRT
- Atypical AVNRT

Accessory pathway
- Manifest accessory pathways
- Concealed accessory pathway
- Pre-excitation pattern
- Asymptomatic pre-excitation (isolated pre-excitation)
- Wolff-Parkinson-White syndrome

Atrioventricular reentrant tachycardia (AVRT)
- Orthodromic AVRT
- Antidromic AVRT

Permanent form of junctional reciprocating tachycardia

### Supraventricular tachycardia (SVT)

An umbrella term used to describe tachycardias (atrial and/or ventricular rates in excess of 100 bpm at rest), the mechanism of which involves tissue from the His bundle or above.

<table>
<thead>
<tr>
<th>Paroxysmal supraventricular tachycardia (PSVT)</th>
</tr>
</thead>
</table>
A clinical syndrome characterized by the presence of a regular and rapid tachycardia of abrupt onset and termination. PSVT represents a subset of SVT.

### Atrial fibrillation (AF)

### Sinus tachycardia
- Physiologic sinus tachycardia
- Inappropriate sinus tachycardia

### Atrial tachycardia (AT)
- Focal AT
- Sinus node reentry tachycardia
- Multifocal atrial tachycardia (MAT)

### Atrial flutter
- Cavotricuspid isthmus–dependent atrial flutter: typical
- Cavotricuspid isthmus–dependent atrial flutter: reverse typical
- Atypical or non–cavotricuspid isthmus–dependent atrial flutter

### Junctional tachycardia

### Atrioventricular nodal reentrant tachycardia (AVNRT)
- Typical AVNRT
- Atypical AVNRT

### Accessory pathway
- Manifest accessory pathways
- Concealed accessory pathway
- Pre–excitation pattern
- Asymptomatic pre–excitation (isolated pre–excitation)
- Wolff–Parkinson–White syndrome

### Atrioventricular reentrant tachycardia (AVRT)
- Orthodromic AVRT
- Antidromic AVRT

### Permanent form of junctional reciprocating tachycardia (PJRT)

Accessory Pathways

- Atrium and ventricle: insulated by cardiac skeleton
- Normally, AV node is the only electrical connection between A and V
Accessory Pathways and Reentry

WPW syndrome
Sinus rhythm

Orthodromic

Antidromic

Concealed AP

PJRT

Mahaim
Accessory Pathways and Reentry

WPW syndrome
Sinus rhythm

SAN

AVN
Accessory Pathways and Reentry

WPW syndrome
Antidromic

SAN ➔ AVN
Accessory Pathways and Reentry

WPW syndrome
Orthodromic

SAN

AVN
Differential Diagnosis of Narrow QRS tachycardia

- QRS duration
- Regularity
- P waves
- RP interval

Typical AVNRT

Pseudo r’ in V1
Pseudo S in the inferior leads

- ABNORMAL ECG -
AVRT with Retrograde P

RP interval ≈ 100 msec
ECG algorithm for AP localization

Step 1
Left Free Wall Accessory Pathways

- LL
- LAL
- LP
- LPL

- I\(\pm\) or \(-\)
- or \(V_1 R > S\)
- aVF\(+\)

Step 2
Subepicardial Accessory Pathways

- II\(-\)
- MCV
- or Venous Anomaly

Step 3
Septal Accessory Pathways

- III \(R > S\)
- AS RAPS

- \(V_1\) or \(+\)
- aVF\(-\)
- PSTA CSOs
- PSMA

- PSTA
- MSTA

Step 4
Right Free Wall Accessory Pathways

- aVF\(+\)
- RA RAL

- \(V_1\) \(+\)
- \(II\) \(+\)
- RL
- RP RPL

J Cardiovasc Electrophysiol 1998;9:2
Accessory Pathway: Left Free Wall

- ABNORMAL ECG -
Accessory Pathway: Septal

- ABNORMAL ECG -

- Unconfirmed Diagnosis -
Accessory Pathway: Right Free Wall
## Differentiation of PSVT in EPS

<table>
<thead>
<tr>
<th>Baseline Observations and Tachycardia Features</th>
<th>Prevalence (%)</th>
<th>Positive Predictive Value (%)</th>
<th>AVNRT</th>
<th>ORT</th>
<th>AT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-excitation present during sinus rhythm</td>
<td>15</td>
<td></td>
<td>10</td>
<td>86</td>
<td>3</td>
</tr>
<tr>
<td>Extranodal response to para-Hisian pacing</td>
<td>18</td>
<td></td>
<td>17</td>
<td>83</td>
<td>0</td>
</tr>
<tr>
<td>VA block cycle length &gt; 600 msec at baseline</td>
<td>11</td>
<td></td>
<td>41</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>Septal VA interval &gt; 70 msec</td>
<td>53</td>
<td></td>
<td>17</td>
<td>59</td>
<td>24</td>
</tr>
<tr>
<td>Eccentric atrial activation</td>
<td>31</td>
<td></td>
<td>0</td>
<td>76</td>
<td>24</td>
</tr>
<tr>
<td>Spontaneous AV block during tachycardia</td>
<td>10</td>
<td></td>
<td>60</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Spontaneous termination with AV block</td>
<td>28</td>
<td></td>
<td>66</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>Development of LBBB</td>
<td>12</td>
<td></td>
<td>4</td>
<td>92</td>
<td>4</td>
</tr>
<tr>
<td>Increase in VA interval &gt; 20 msec with BBB</td>
<td>7</td>
<td></td>
<td>0</td>
<td>100</td>
<td>0</td>
</tr>
</tbody>
</table>
Eccentric Atrial Activation

- RV
- HRA
- His
- Proximal CS
- Distal CS

Diagram showing the pathways of atrial activation with red and green arrows indicating the direction of activation.
Induction with AH Jump and Concentric Atrial Activation
His Synchronous Ventricular Extrastimulation (V reset)

406 msec
382 msec
His Synchronous Ventricular Extrastimulation (V reset)
PPI-TCL: AVRT

510 msec

442 msec

PPI-TCL = 68 (<115)
PPI-TCL: AVNRT

521 msec - 337 msec

PPI-TCL = 184 (≥115)
Coumel’s law

- Positive Prediction Value: 100% in ORT
- Ipsilateral BBB produces prolonged TCL
Coumel’s law

294 msec
251 msec
243 msec
Ipsilateral BBB
TCL: 294 ms

Narrow QRS
TCL: 251 ms

Contralateral BBB

SAN A VN

294 msec
251 msec
243 msec
Acute treatment of orthodromic AVRT

**Acute treatment of orthodromic AVRT**

---

**Recommendations for Acute Treatment of Orthodromic AVRT (Continued)**

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| Iib | B-R | 1. Intravenous beta blockers, diltiazem, or verapamil might be considered for acute treatment in patients with orthodromic AVRT who have pre-excitation on their resting ECG and have not responded to other therapies.  

Intravenous beta blockers, diltiazem, and verapamil have a risk of enhancing conduction over the accessory pathway if the AVRT converts to AF during administration of the medication. Should the patient have a rapidly conducting manifest accessory pathway, further enhancing accessory-pathway conduction during AF by shortening the refractory period (digoxin) or decreasing BP and increasing catecholamines (diltiazem, beta blockers, verapamil) may place the patient at risk of AF degenerating into a malignant ventricular arrhythmia. The ability to promptly perform electrical cardioversion must be available should AF with rapid ventricular conduction occur. Before intravenous beta blockers, diltiazem, and verapamil were available, intravenous digoxin was commonly used for acute treatment of patients with orthodromic AVRT who had pre-excitation on their resting ECG; this agent is rarely used now because other agents are available and digoxin may put patients at risk of ventricular fibrillation.  

2. Intravenous digoxin, intravenous amiodarone, intravenous or oral beta blockers, diltiazem, and verapamil are potentially harmful for acute treatment in patients with pre-excited AF.  

Patients with pre-excited AF should not receive intravenous digoxin, intravenous amiodarone, or intravenous/oral beta blockers, diltiazem, or verapamil because these medications may enhance conduction over the accessory pathway, increase the ventricular rate, and increase the risk of provoking a life-threatening ventricular arrhythmia. Digoxin increases the ventricular rate by shortening refractoriness of the accessory pathway, whereas amiodarone, beta blockers, diltiazem, and verapamil may increase the ventricular rate as a result of drug-induced hypotension with increased catecholamines. In addition, these medications may enhance conduction over the accessory pathway by slowing or blocking conduction through the AV node, preventing competitive concealed retrograde conduction into the accessory pathway.

See Online Data Supplements 11 and 12. |
Ongoing management of orthodromic AVRT

Success and Complication Rate for Ablation of AVRT

- Acute success rate: 93%
- Recurrent Rate: 8%
- Major Complications
  Overall 2.8%
  PPM 0.3%
  Death 0.1%
  Tamponade 0.4%

Hooray!!
Thank you for your attention