Diagnostic pacing maneuvers for SVT

1. Excellent, concise, well-illustrated review of traditional and newer concepts
   Veenhuyzen G et al. PACE 34:767 2011
   Part 2 PACE 35:575 2012

Mid-Long RP Tachycardia

1. Atypical AVNRT
2. Atrial tachycardia
3. Septal AP
4. Concealed N-F tachycardia
5. Junctional Tachycardia

Features of Atrial Tachycardia

1. Tachycardia persists in spite of AV block
2. Initiation of tachycardia without need for ventricle
3. Atrial premature beats or atrial overdrive pacing unhooks post pacing atrial complex
4. A-H interval during tachycardia is similar to paced A-H at same rate
5. VA-AV response to ventricular pacing
Atrial Tachycardia

VAAV response


V-A-H response (HV>VA)

CL (Ent)=AH+HV+VA
PR1 TCl < 110 ms

AVNRT

ORT

V-A-H response (HV>VA)

CL (Ent)=AH+HV+VA
PR1 TCl < 110 ms

PACE 34:767

VOP S-V >85, cPPI-TCL (PPI-TCL-) >110ms favors AVNRT
Response to VOD during ORT

1. In all pts. With typical septal AP: PPI – TCL = <115 ms and SA-VA = <85 ms
2. 6/12 with slowly conducting AP: PPI – TCL >115 ms and SA-VA = >85 ms
3. Slowly conducting AP frequently give entrainment criteria similar to AVNRT

Bennett M/Klein G. Circ Arrhythm 4:506, 2011

Entrainment for distinguishing atypical AVNRT from Septal AP with long RP relationship

OTHER PITFALLS USING VOP DURING SVT

- Tachycardia may terminate
- Doesn’t prove that pathway is part of circuit
- Not appropriate for left lateral AP

Manifest fusion best recognized when pacing near the AP
Manifest fusion during entrainment

Unfused

Entrainment with fusion Ventricular complexes

VOP during ORT

Capture with first fused Ventricular paced complex

VOP during AVNRT

Capture by 4th beat and no fusion favors AVNRT

Number of non fused V to capture A

Dandamuda Heart Rhythm 7 1326
Novel approach to differentiating ORT from AVNRT

1. In all orthodromic reciprocating tachycardia (ORT) patients atrial capture occurred after the first non-fused paced QRS in all patients during ventricular overdrive pacing (VOP)

2. All AVNRT patients showed atrial capture after 2 or 3 beats after the first unfused QRS

3. Technique most valuable for patients who have SVT termination during VOP

Limitations: may not distinguish AP bystander

Dandamudi et al. Heart Rhythm 7:1326, 2010

PITFALLS USING VOP DURING SVT

1. Doesn’t distinguish decremental AP

2. Doesn’t distinguish presence of bystander AP

3. Fusion with capture may not be seen within 3 beats in left lateral AP

Para-Hisian pacing demonstrating retrograde conduction over AV nodal pathway


Figure 2. Delay of atrial activation by a His-refractory ventricular premature beat (HRVPB). During a long R-P

Insert PVC close to atrial insertion of AP

PACE 35:757 2012
Para-Hisian pacing demonstrating retrograde conduction over Anteroseptal AP


Determination of inadvertent atrial capture during para-hisian pacing

1. Stim HRA and Stim PCS were measured during atrial capture
2. Stim HRA <70ms or stim PCS <60ms – was always observed with atrial capture
3. Stim HRA >100ms or stim PCS >90ms – observed only in absence of atrial capture
4. Stim HRA <85ms and stim CS <85ms – highly sensitive to detect atrial capture
5. For those in overlap zone ➔ reposition catheter

Obeyesekere/Klein G. Circ Arrhythm 4:510, 2011

PITFALLS USING PARA-HISIAN ENTRAINMENT

1. Relative conduction times of retrograde nodal vs AP
2. Not reliable for left lateral AP
3. Proves presence of septal AP but doesn’t mean the AP is critical to circuit
4. Inadvertent Atrial capture
Figure 4. Apex versus base pacing consistent with the presence of an accessory pathway. Panel A shows right ventricular (RV) apical pacing (note the superior QRS

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Concealed nodofascicular tachycardia

- SVT initiated with atrial programmed stimulation (often with dual response) or ventricular extrastimuli
- Evidence of AV dissociation during SVT or A on V TACH. SVT (rules out extranodal AP)
- PVC on His during SVT advances the next His / V or terminates SVT
- Bundle branch block leads to prolongation of VA interval or tachycardia cycle length

Narrow complex tachycardia with VA block

AV nodal reentrant tachycardia
Junctional tachycardia
Concealed nodofascicular tachycardia
Ablator signal within CS in sinus rhythm

Proposed circuit for left sided concealed nodofascicular tachycardia

Focal Junctional Tachycardia

- Narrow complex tachycardia at times associated with AV dissociation often irregular
- Catecholamine stimulation (abnormal automaticity)
- Initiation with atrial and ventricular overdrive pacing (triggered)
- Termination with adenosine (triggered)
- Earliest retrograde A preceded or buried in the QRS
- Late APD after His is committed does not affect tachycardia

Tachycardia initiation
Conclusion

- Ventricular Pacing maneuvers are key to separating atypical AVNRT from Septal AP
- Nodo-Fascicular/Ventricular diagnosed by excluding Atrial participation but finding evidence for an accessory pathway
- Junctional tachycardia best diagnosed at onset with out need for critical AH and response to late and early APCs
SA-VA=75 cPPI-TCL= 110ms

The 2nd paced beat (fused) terminates
SVT proves AVRT

Successful ablation site in the CS
Veenhuyzen PACE 34:767 2011

Table 1. Six Features of SVT to Consider before Considering a Diagnostic Pacing Maneuver

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
<th>SVT Mechanism(s)</th>
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<tbody>
<tr>
<td>1. VA relationship</td>
<td>V = A</td>
<td>AVNRT, AVRT, AT</td>
</tr>
<tr>
<td></td>
<td>V ≠ A, AV dissociation</td>
<td>AVNRT, AVRT, AT</td>
</tr>
<tr>
<td>2. VA interval</td>
<td>VA &gt; 70 ms</td>
<td>AT, AVNRT, AVRT, AVRT</td>
</tr>
<tr>
<td></td>
<td>VA ≤ 70 ms</td>
<td>AVNRT, AVRT, AVRT</td>
</tr>
<tr>
<td>3. Atrial activation sequence</td>
<td>High to low concentric</td>
<td>AT, AVNRT, AVRT, AVRT</td>
</tr>
<tr>
<td>4. Spontaneous termination</td>
<td>Ends with an &quot;A&quot;</td>
<td>AVNRT, AVRT, AVRT</td>
</tr>
<tr>
<td></td>
<td>Ends with a &quot;V&quot;</td>
<td>AVNRT, AVRT, AVRT</td>
</tr>
<tr>
<td>5. His changes precede and predict</td>
<td>Yes</td>
<td>AVNRT, AVRT, AT</td>
</tr>
<tr>
<td>AA changes</td>
<td>No</td>
<td>AVNRT, AVRT, AT</td>
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<tr>
<td>6. VA increase &gt; 30 ms with</td>
<td>Yes</td>
<td>AVNRT with free wall AP activated to</td>
</tr>
<tr>
<td>paced extrasystole</td>
<td></td>
<td>AVNRT</td>
</tr>
</tbody>
</table>

Excludes AT and JT

Figure 1. Advancement of atrial activation by a fused His-refractory ventricular premature beat (HHVPB).

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Figure 2. Postspacing interval minus the tachycardia cycle length (PR – TCL) and the difference in the ventriculoatrial interval during pacing and tachycardia (BA – VA). In this patient, the PR – TCL is 197 ms, and the BAAA – VA is 185 ms. Abbreviations as in Figure 1.

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Figure 3. SVT arising from an accessory pathway. The running V waves are at a rate of 180 bpm, and the atrial tachycardia is 140 bpm. The AV nodal node and the atrial tachycardia are shown simultaneously.

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Figure 4. Pacing for SVT arising from an accessory pathway. The atrial tachycardia is 160 bpm, and the atrial tachycardia is at a rate of 180 bpm. The AV node and the atrial tachycardia are shown simultaneously.
Integrating Devices And Pharmacotherapies

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