Tachycardia Diagnosis and Management: Differentiating SVT, Atrial Flutter, & Atrial Fibrillation

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Objectives

1. Mechanisms of SVTs
2. How to Approach the Diagnosis of SVTs
3. SVT Example Cases
I. Mechanisms of Supraventricular Tachycardias
2. Approach to Diagnose Tachycardias

Wide Complex Tachycardias

- VT
- Antidromic AVRT
- SVT with aberrancy

Narrow Complex Tachycardias

Irregular QRS’s

- Atrial fibrillation
- Atrial flutter with variable block
- Multifocal Atrial Tach (MAT)

Regular QRS’s

- A on V Tach
- Short RP
- Long RP

- Typical AVNRT
- Orthodromic AVRT
- PJRT
- Orthodromic AVRT with slow AP
2. Approach to Diagnose Tachycardias

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- Atypical AVNRT
- Atrial Tach
- PJRT
- Junctional Tach
- Atrial Tach
- Atrial Tach
Tips and tricks to analyze the surface ECG

1. Scan up and down the ECG leads to look for retrograde P waves or AFL F-wave. All 12-lead ECGs are simultaneous.

   • Compare QRS and T-wave morphology of SVT to baseline sinus rhythm ECG

   • Compare the terminal portion of the QRS to look for any changes that may suggest an overlying retrograde P wave or AFL F-wave
Tips and tricks to analyze the surface ECG

2. Look for P waves during periods of varying ventricular rate, pauses with AV block or after a PVC
3. During sinus rhythm, look for pre-excitation (delta wave) if suspecting AVRT

- If V5 and V6 have any q waves during sinus rhythm, patient is unlikely to have an accessory pathway.
Tips and tricks to analyze the surface ECG

No Pre-excitation

Pre-excitation
Tips and tricks to analyze the surface ECG

4. Give adenosine or do vagal maneuvers to study the effect of AV node blockade on the SVT
   - Slowing down the QRS complexes will make atrial flutter or atrial fibrillation waves more obvious
   - AV block will terminate AV node-dependent SVTs (AVNRT and AVRT). Can also terminate atrial tachycardia in 40% of cases.
   - Caveat: Do not give adenosine in patients with WPW and atrial fibrillation due to risk of precipitating VF. Dedicated conduction over an accessory pathway may facilitate 1:1 AV conduction, leading to VF.
How to give adenosine

- Hook up to a crash cart in case transcutaneous pacing or cardioversion is needed due to heart block.
- Run a 12 lead rhythm strip while giving adenosine.
- Give a 6mg push followed by a 10cc saline flush in a large bore IV. If no effect, give 12mg push followed by a 10cc saline flush.
Narrow Complex Tachycardias: Irregular QRS Rhythms

1. Atrial fibrillation
2. Atrial flutter
3. Multifocal atrial tachycardia
2. Approach to Diagnose Tachycardias

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- VT
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Atrial Tach
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Narrow Complex Tachycardias:
Irregular QRS's:
Atrial Fibrillation
Narrow Complex Tachycardias:
Irregular QRS’s:
Atrial Flutter with Variable Block
Atrial Fibrillation Versus Atrial Flutter?

Coarse Atrial Fibrillation
Atrial Fibrillation Versus Atrial Flutter

- Does it matter?

Acute medical management (anticoagulation and rate control) is similar, but ablation indication/success is different!
Narrow Complex Tachycardias: Irregular QRS’s: **Typical (cavotricuspid isthmus-dependent atrial flutter)**

- Usually atrial rate is 300 bpm and ventricular conduction is 150 bpm (with 2:1 AV block).
- With 2:1 AV block, flutter waves (F-waves) are often buried in QRS and T wave.
- No isoelectric interval between QRS’s, look for sloping lines instead.
- In typical CTI-dependent flutter, the gradual slope of F wave is negative in inferior leads and positive in V1, representing counterclockwise activation of right atria.

[Graphs of Lead II and Lead V1 showing the characteristics of typical CTI-dependent atrial flutter.]
Narrow Complex Tachycardias:
Irregular QRS’s:
**Multifocal Atrial Tachycardia (MAT)**
Narrow Complex Tachycardias: 
Irregular QRS’s: 
**Multifocal Atrial Tachycardia (MAT)**

- 3 different P wave morphologies without a single dominant P wave
- Usually found in patients with significant pulmonary disease (emphysema, pulmonary hypertension)

**Treatment:**

1. Treat underlying pulmonary disease.
2. If fast ventricular rates that are symptomatic or hemodynamically compromising, rate control with CCB or BB
3. No role for cardioversion.
Narrow Complex Tachycardias: Regular QRS Rhythms

1. Atrial flutter
2. A on V tachycardias
3. Short RP tachycardias
4. Long RP tachycardias
2. Approach to Diagnose Tachycardias

Wide Complex Tachycardias

- VT
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Narrow Complex Tachycardias

Irregular QRS’s

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Regular QRS’s

Atrial flutter

- A on V Tach
- Short RP
- Long RP

- Typical AVNRT
- Orthodromic AVRT
- Ortho-dromic AVRT with slow AP
- Atypical AVNRT
- Atrial Tach
- PJRT
Strategies to differentiate between atrial flutter with 2:1 AV block vs other regular SVTs?

1. Look in between QRS intervals during intermittent ventricular pauses
2. Give Adenosine

SVT: AVNRT

Atrial Flutter
Narrow Complex Tachycardias:
Regular QRS’s:
Atrial flutter or SVT?
Narrow Complex Tachycardias:
Regular QRS’s:
Atrial Flutter
Narrow Complex Tachycardias: Regular QRS’s: Atrial flutter or SVT?

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<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Vent. rate</td>
<td>134 BPM</td>
<td>Sinus tachycardia with short PR</td>
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<tr>
<td>PR interval</td>
<td>98 ms</td>
<td>Left ventricular hypertrophy with secondary repolarization abnormality</td>
</tr>
<tr>
<td>QRS duration</td>
<td>90 ms</td>
<td>Abnormal ECG</td>
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<td>QT/QTc</td>
<td>326/486 ms</td>
<td>Confirmed byAbove generated by computer only, Results in ED notes (204), editor Warrick, Ashley (534) on 7/22/2016 9:20:14 AM</td>
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<td>P-R-T axes</td>
<td>* -1 131</td>
<td></td>
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</tbody>
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Technician: RMS9
Test ind: A FLUTTER

Referred by: REFERRED SELF

Confirmed By: Results in ED notes Above generated by computer only
Narrow Complex Tachycardias:
Uniform QRS's:
Atrial Flutter with 2:1 Block → give adenosine

Referred by: DE MARIA
Confirmed By: Kurt Hoffmayer
Narrow Complex Tachycardias: Regular QRS Rhythms A on V Tachycardias

1. Typical AVNRT
2. Junctional Tachycardia
2. Approach to Diagnose Tachycardias

Wide Complex Tachycardias
- VT
- Antidromic AVRT
- SVT with aberrancy

Narrow Complex Tachycardias
- Irregular QRS’s
  - Atrial fibrillation
  - Atrial flutter with variable block
  - Multifocal Atrial Tach (MAT)
- Regular QRS’s
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  - Orthodromic AVRT
  - Orthodromic AVRT with slow AP
I. Mechanisms of Supraventricular Tachycardias
Narrow Complex Tachycardias: Regular QRS
A on V Tachycardias:
**Typical Atrioventricular Node Reentrant Tachycardia (AVNRT)**
Narrow Complex Tachycardias: Regular QRS
A on V Tachycardias:
**Typical Atrioventricular Node Reentrant Tachycardia (AVNRT)**

- Re-entry down the slow pathway
  and up the fast pathway in the AV node

- Bimodal age distribution: presents in teens or age 40-50s

- Treatment:
  - Acute: adenosine, IV AV node blocker (metoprolol or diltiazem)
  - Chronic: AVN blockers (beta blocker or CCB), Class 1c anti-arrhythmics (flecainide or propafenone)
  - Definitive: Ablation (>95% successful)
Narrow Complex Tachycardias:
Regular QRS A on V Tachycardias:
Typical Atrioventricular Node Reentrant Tachycardia (AVNRT)
Narrow Complex Tachycardias: Regular QRS Rhythms Short RP Tachycardias

1. Orthodromic AVRT (ORT)
2. Typical or Atypical AVNRT
3. Atrial Tachycardia with 1st degree AV block
I. Mechanisms of Supraventricular Tachycardias
Narrow Complex Tachycardias:
Regular QRS
Short RP Tachycardias:
Orthodromic Atrioventricular Reentrant Tachycardia (ORT or Orthodromic AVRT)
Narrow Complex Tachycardias:
Regular QRS
Short RP Tachycardias:
**Orthodromic Atrioventricular Reentrant Tachycardia (ORT or Orthodromic AVRT)**
Narrow Complex Tachycardias:
Regular QRS
Short RP Tachycardias:
**Orthodromic Atrioventricular Reentrant Tachycardia (ORT or Orthodromic AVRT)**: no baseline pre-excitation
Narrow Complex Tachycardias:
Regular QRS
Short RP Tachycardias:
Orthodromic Atrioventricular Reentrant Tachycardia (ORT or Orthodromic AVRT)

- Re-entry down the AV node and up an accessory pathway
- Usually presents in childhood (before teens) or later if asymptomatic
- Accessory pathways can conduct antegrade-only (5%), retrograde-only (37%) or bidirectional (60%).
  - Antegrade conduction is called manifest (and usually creates delta wave)
  - Retrograde-only conduction is called concealed (no delta wave)
  - ORT can occur in the absence of manifest pre-excitation (delta wave) on the ECG since it utilizes the AP in the retrograde direction
- Delta wave:
  - Short PR (<120ms)
  - Slurred upstroke and wide QRS (>120ms)
Narrow Complex Tachycardias: Regular QRS
Short RP Tachycardias:
**Orthodromic Atrioventricular Reentrant Tachycardia (ORT or Orthodromic AVRT)**

- **Treatment:**
  - **Acute:**
    - IV Class Ia (procainamide), Ic (flecainide) or III (ibutilide, amiodarone) agents to slow or block accessory pathway
    - Use adenosine and CCB with caution (don’t use if pt ever has history of AF)
    - Cardioversion
  - **Chronic:**
    - Antiarrhythmics as above
    - Beta blocker only if accessory pathway is not capable of rapid conduction (loss of pre-excitation/delta wave during sinus tachycardia or during EP study)
  - **Definitive:** Ablation is first line therapy (>95% success rate) for ORT
Narrow Complex Tachycardias:
Regular QRS Rhythms
Long RP Tachycardias

1. Focal atrial tachycardia
2. Atypical AVNRT
I. Mechanisms of Supraventricular Tachycardias
Narrow Complex Tachycardias:
Regular QRS
Long RP Tachycardias:
Focal Atrial Tachycardia
Narrow Complex Tachycardias:
Regular QRS
Long RP Tachycardias:
Focal Atrial Tachycardia: with adenosine
Narrow Complex Tachycardias:
Regular QRS
Long RP Tachycardias:
Focal Atrial Tachycardia

• Focal AT can be caused by automatic, triggered or micro-reentrant activity

• Treatment:
  • Acute:
    • Sometimes terminates with adenosine
    • CCB/BB (rate control or sometimes terminates)
    • IV Class IA (procainamide), IC (flecainide) or III (amiodarone)
    • Cardioversion (can terminate triggered or micro-reentrant AT)
  • Chronic:
    • BB or CCB
    • Any antiarrhythmic
    • If refractory to meds, then ablation (success rate 90%)
Narrow Complex Tachycardias:
Regular QRS
Long RP Tachycardias:
Focal Atrial Tachycardia: Right Atrial Appendage
Narrow Complex Tachycardias:
- Regular QRS
- Long RP Tachycardias:
  - Atypical AVNRT
Narrow Complex Tachycardias:
Regular QRS
Long RP Tachycardias:
Atypical AVNRT
Narrow Complex Tachycardias:
- Regular QRS
- Long RP Tachycardias:
  - Atypical AVNRT

Atypical AVNRT

Atrial Flutter

Sinus tachycardia with short PR
Left ventricular hypertrophy with severe
Abnormal ECG
Confirmed by above generated by cpc
7/22/2016 9:20:14 AM

UC San Diego Health
Wide Complex Tachycardias:

1. VT
2. Antidromic AVRT
3. SVT with aberrancy
Wide Complex Tachycardias: Antidromic Atrioventricular Re-entrant Tachycardia (AVRT)
Wide Complex Tachycardias:
Antidromic Atrioventricular Re-entrant Tachycardia (AVRT): Sinus Rhythm with WPW
Wide Complex Tachycardias: Antidromic Atrioventricular Re-entrant Tachycardia (AVRT)
ECGs