Supraventricular Tachycardias

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Disclosures

• Amarin – Chair DSMB – REDUCE-IT Trial
• Boehringer Ingelheim – co-coordinator GLORIA-AF Trial
• Sanofi Aventis – consultant
• Lundbeck – consultant and speaker
• Respicardia - consultant
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|| ACC/AHA Task Force on Clinical Practice Guidelines Liaison.
Aims of This Talk

• Define supraventricular tachycardia (SVT) and its types
• Discuss utilizing the electrocardiogram to diagnose SVTs
• Review acute and long-term management of SVT including medical management and ablation techniques
Normal Sinus Rhythm
Supraventricular Tachycardia

- **SVT** - A rhythm disturbance, rate >100 bpm, requiring tissue above His-Purkinje system to perpetuate

- **Presentation** - *regular* (AV node reentry), *irregular* (atrial flutter with variable conduction) or *irregularly irregular* (atrial fibrillation), QRS can narrow, wide or both

- **Mechanisms** – reentry, automaticity, triggered automaticity

- **Consequences** – asymptomatic, palpitations, heart failure, syncope, ischemia, cardiac arrest
Causes of SVT

- Sinus tachycardia (appropriate and inappropriate)
- AV node reentry tachycardia
- AV reentry tachycardia
- Sinoatrial reentry tachycardia/Atrial tachycardia
- Accelerated junctional tachycardia
- Atrial flutter
- Atrial fibrillation
### Inappropriate Sinus Tachyarrhythmias – Ongoing Management

<table>
<thead>
<tr>
<th>COR</th>
<th>LOE</th>
<th>Recommendations</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>C-LD</td>
<td>Evaluation for and treatment of reversible causes are recommended in patients with suspected IST.</td>
</tr>
<tr>
<td>IIa</td>
<td>B-R</td>
<td>Ivabradine is reasonable for ongoing management in patients with symptomatic IST.</td>
</tr>
<tr>
<td>IIb</td>
<td>C-LD</td>
<td>Beta blockers may be considered for ongoing management in patients with symptomatic IST.</td>
</tr>
<tr>
<td>IIb</td>
<td>C-LD</td>
<td>The combination of beta blockers and ivabradine may be considered for ongoing management in patients with IST.</td>
</tr>
</tbody>
</table>
Mechanisms of SVT

AVRT  AVNRT  AT/ST/AF

A  A  A

AV node  AV node  AV node

AP  AP  AP

RB  LB  RB  LB  RB  LB

V  V  V
Palpitations – Narrow QRS Tachycardia
Differential Diagnosis for Adult Narrow QRS Tachycardia

Narrow QRS tachycardia (QRS duration <120 ms)

- Regular tachycardia
  - Yes
  - No
- Visible P waves
  - Yes
  - No
- Atrial rate greater than ventricular rate
  - Yes
  - No
- Atrial flutter or Atrial tachycardia
  - Yes
  - No
- RP interval short (RP <PR)
  - Yes
  - No (RP >PR)
  - Yes
  - No
  - Yes
  - No
- Atrial tachycardia, PJRT, or Atypical AVNRT
  - AVNRT
  - AVRT, Atypical AVNRT, or Atrial tachycardia

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Acute Treatment of Regular SVT of Unknown Mechanism

Regular SVT

Vagal maneuvers and/or IV adenosine (Class I)

If ineffective or not feasible

Hemodynamically stable

Yes

IV beta blockers, IV diltiazem, or IV verapamil (Class IIa)

If ineffective or not feasible

Synchronized cardioversion* (Class I)

No

Synchronized cardioversion* (Class I)

Colors correspond to Class of Recommendation in Table; drugs listed alphabetically.

*For rhythms that break or recur spontaneously, synchronized cardioversion is not appropriate.

IV indicates intravenous; and SVT, supraventricular tachycardia.

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Ongoing Management of SVT of Unknown Mechanism

**Regular SVT**

- **Pre-excitation present in sinus rhythm**
  - Yes
    - Ablation candidate, willing to undergo ablation
      - Yes
        - EP study and catheter ablation (Class I)
      - No
        - Ablation candidate, pt prefers ablation
          - Yes
            - EP study and catheter ablation (Class I)
          - No
            - Drug options
              - **Beta blockers, diltiazem, or verapamil,** *(in the absence of pre-excitation)* *(Class I)*
              - **Flecainide or propafenone** *(in the absence of SHD)* *(Class IIa)*
              - **Amiodarone, dofetilide, or sotalol** *(Class IIb)*
              - **Digoxin** *(in the absence of pre-excitation)* *(Class IIb)*

- No
  - Medical therapy*
    - If ineffective
      - EP study and catheter ablation (Class I)
  - If ineffective
    - Drug options
      - **Beta blockers, diltiazem, or verapamil,** *(in the absence of pre-excitation)* *(Class I)*
      - **Flecainide or propafenone** *(in the absence of SHD)* *(Class IIa)*
      - **Amiodarone, dofetilide, or sotalol** *(Class IIb)*
      - **Digoxin** *(in the absence of pre-excitation)* *(Class IIb)*

*Colors correspond to Class of Recommendation in Table; drugs listed alphabetically.
*Clinical follow-up without treatment is also an option.
EP indicates electrophysiological; pt, patient; SHD, structural heart disease (including ischemic heart disease); SVT, supraventricular tachycardia; and VT, ventricular tachycardia.

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What is the Diagnosis?

AV Node Reentry Supraventricular Tachycardia
Acute Treatment of AVNRT

**AVNRT**

- IV beta blockers
- IV diltiazem
- or IV verapamil
  - (Class IIa)
- IV amiodarone
  - (Class IIb)

If ineffective or not feasible:

- Oral beta blockers, diltiazem, or verapamil may be reasonable for acute treatment in hemodynamically stable patients with AVNRT (Class IIb)

**Hemodynamically stable**

- Vagal maneuvers and/or IV adenosine
  - (Class I)

If ineffective or not feasible:

- Synchronized cardioversion*
  - (Class I)

**Colors correspond to Class of Recommendation in Table; drugs listed alphabetically.**

*For rhythms that break or recur spontaneously, synchronized cardioversion is not appropriate.

AVNRT indicates atrioventricular nodal reentrant tachycardia; and IV, intravenous.

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Ongoing Management of AVNRT

AVNRT

Symptomatic

Yes

Clinical follow-up without treatment (Class IIa)

No or minimally symptomatic

Reassess symptoms during follow-up

Ablation candidate, pt prefers ablation

Yes

Slow-pathway catheter ablation (Class I)

If ineffective, consider ablation

Beta blockers, diltiazem, or verapamil (Class I)

If ineffective

Flecainide or propafenone (in the absence of SHD) (Class IIa)

Amiodarone, digoxin, dofetilide, or sotalol (Class IIb)

If ineffective, consider ablation

Self-administration of beta blockers, diltiazem, or verapamil in pts with infrequent, well-tolerated episodes of AVNRT (Class IIb)

Colors correspond to Class of Recommendation in Table; drugs listed alphabetically. AVNRT indicates atrioventricular nodal reentrant tachycardia; pt, patient; and SHD, structural heart disease (including ischemic heart disease).

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AVRT

“A long RP tachycardia”
Wide QRS 170 BPM  Narrow QRS 215 BPM

The rhythm strip demonstrates?

1) VT converting to SVT
2) SVT with and without aberration
Speeding Up

What is going on here?

Courtesy Josep Brugada
Acute Treatment of Orthodromic AVRT

Orthodromic AVRT

Vagal maneuvers and/or IV adenosine (Class I)

If ineffective or not feasible

Hemodynamically stable

Yes

Pre-excitation on resting ECG

Synchronized cardioversion (Class I)

If ineffective or not feasible

No

IV beta blockers, IV diltiazem, or IV verapamil (Class IIb)

If ineffective or not feasible

Synchronized Cardioversion* (Class I)

Colors correspond to Class of Recommendation in Table; drugs listed alphabetically.

*For rhythms that break or recur spontaneously, synchronized cardioversion is not appropriate.

AVRT indicates atrioventricular reentrant tachycardia; ECG, electrocardiogram; and IV, intravenous.
### Ongoing Management of Orthodromic AVRT

**Orthodromic AVRT**

**Pre-excitation on resting ECG**

- **Yes**
  - **Ablation candidate, willing to undergo ablation**
    - **Flecainide or propafenone** *(in the absence of SHD)* *(Class IIa)*
    - **Amiodarone, beta blockers, diltiazem, dofetilide, sotalol, or verapamil** *(Class IIb)*
    - If ineffective, consider ablation

- **No**
  - **Ablation candidate, pt prefers ablation**
    - **Catheter ablation** *(Class I)*
    - **Beta blockers, diltiazem, or verapamil** *(Class I)*
    - **Flecainide or propafenone** *(in the absence of SHD)* *(Class IIa)*
    - **Amiodarone, digoxin, dofetilide, or sotalol** *(Class IIb)*
    - If ineffective, consider ablation

Colors correspond to Class of Recommendation in Table; drugs listed alphabetically. AVRT indicates atrioventricular reentrant tachycardia; ECG, electrocardiogram; pt, patient; and SHD, structural heart disease (including ischemic heart disease).

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Long RP Tachycardia

Termination with adenosine

What is this?
LVEF = 20%, FC IV CHF - 38 yo Female

What is the diagnosis?

PJRT - permanent junctional reciprocating tachycardia
Palpitations in a 23 yo male

What is the likely diagnosis?

Atrial fibrillation with the Wolff-Parkinson White Syndrome
Palpitations in a 23 yo male

Afib -> VF
What is the Diagnosis?

Anterior left accessory pathway with WPW pattern
What is the Diagnosis?

Anterior accessory pathway with WPW pattern
What is the Diagnosis?

Right-sided accessory pathway with WPW pattern
Sinus tachy?
Acute Treatment of Suspected Focal Atrial Tachycardia

Suspected focal atrial tachycardia

Hemodynamically stable

Yes

No

Diagnosis of focal atrial tachycardia established

Yes

No

IV beta blocker, IV diltiazem, or IV verapamil (Class I)

If ineffective

IV amiodarone or IV ibutilide (Class IIb)

IV adenosine (Class IIa)

If ineffective or not feasible

Cardioversion* (Class I)

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Colors correspond to Class of Recommendation in Table; drugs listed alphabetically. *For rhythms that break or recur spontaneously, synchronized cardioversion is not appropriate. IV indicates intravenous.
Ongoing Management of Focal Atrial Tachycardia

Focal atrial tachycardia

Ablation candidate, pt prefers ablation

Yes

Catheter ablation (Class I)

Beta blockers, diltiazem, or verapamil (Class IIa)

Flecainide or propafenone (in the absence of SHD) (Class IIa)

Amiodarone or sotalol (Class IIb)

Drug therapy options

No

If ineffective

Colors correspond to Class of Recommendation in Table; drugs listed alphabetically.
Pt indicates patient; and SHD, structural heart disease (including ischemic heart disease).

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What is the Rhythm?

Atrial flutter with 2:1 conduction
The Rate Never Changes
Atrial Flutter and Adenosine
Atrial Flutter - Variable Conduction

May appear like atrial fibrillation in some leads
Acute Treatment of Atrial Flutter

Hemodynamically stable

Yes

Treatment strategy

Rhythm control*
- Synchronized cardioversion†, oral dofetilide, IV ibutilide, and/or rapid atrial pacing† (Class I)

Rate control
- IV beta blockers, IV diltiazem, or IV verapamil (Class I)
- IV amiodarone (Class IIa)

No

Treatment strategy

Rhythm control*
- Synchronized cardioversion (Class I)
- IV amiodarone (Class IIa)

Rate control

Colors correspond to Class of Recommendation in Table; drugs listed alphabetically.

*Anticoagulation as per guideline is mandatory.
†For rhythms that break or recur spontaneously, synchronized cardioversion or rapid atrial pacing is not appropriate.
IV indicates intravenous.

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Ongoing Management of Atrial Flutter

Atrial flutter

Treatment strategy

Rate control

Beta blockers, diltiazem, or verapamil (Class I)

Catheter ablation (Class I)

Rhythm control*

Amiodarone, dofetilide, or sotalol (Class IIa)

Flecainide or propafenone (in the absence of SHD)† (Class IIb)

Options to consider

If ineffective

Colors correspond to Class of Recommendation in Table 1, drugs listed alphabetically.

*After assuring adequate anticoagulation or excluding left atrial thrombus by transesophageal echocardiography before conversion.

†Should be combined with AV nodal–blocking agents to reduce risk of 1:1 conduction during atrial flutter.

AV indicates atrioventricular; SHD, structural heart disease (including ischemic heart disease).
Atrial Flutter->Atrial Fibrillation

More difficult to control ventricular rate during atrial flutter
Concept of electrotonic inhibition or concealed conduction

Anselme F. Circulation 1999;99:534-540
What is the Rhythm?

Atrial fibrillation with uncontrolled rate
### Recommendations for Acute Treatment of Focal Atrial Tachycardia

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<td>I</td>
<td>C-LD</td>
<td>Intravenous beta blockers, diltiazem, or verapamil is useful for acute treatment in hemodynamically stable patients with focal AT.</td>
</tr>
<tr>
<td>I</td>
<td>C-LD</td>
<td>Synchronized cardioversion is recommended for acute treatment in patients with hemodynamically unstable focal AT.</td>
</tr>
<tr>
<td>IIa</td>
<td>B-NR</td>
<td>Adenosine can be useful in the acute setting to either restore sinus rhythm or diagnose the tachycardia mechanism in patients with suspected focal AT.</td>
</tr>
</tbody>
</table>
Nonsinus Focal Atrial Tachycardia and MAT – Focal Atrial Tachycardia Acute Treatment (cont’d)

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<td>IIb</td>
<td>C-LD</td>
<td>Intravenous amiodarone may be reasonable in the acute setting to either restore sinus rhythm or slow the ventricular rate in hemodynamically stable patients with focal AT.</td>
</tr>
<tr>
<td>IIb</td>
<td>C-LD</td>
<td>Ibutilide may be reasonable in the acute setting to restore sinus rhythm in hemodynamically stable patients with focal AT.</td>
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SVT - Summary

• Sinus tachycardia (appropriate and inappropriate)
• AV node reentry tachycardia
• AV reentry tachycardia
• Sinoatrial reentry tachycardia/Atrial tachycardia
• Accelerated junctional tachycardia
• Atrial flutter
• Atrial fibrillation
Conclusions

• SVT, a common problem with multiple causes
• The diagnosis is made by specific ECG patterns
• Acute and chronic management varies by type of SVT, frequency, symptoms and risks of recurrence
• Ablation can be effective to treat most SVTs
Ongoing Management of Junctional Tachycardia

Junctional tachycardia

Drug therapy options

Beta blockers, diltiazem, or verapamil (Class IIa)

Flecainide or propafenone (in the absence of SHD) (Class IIb)

If ineffective or contraindicated

Catheter ablation (Class IIb)

Colors correspond to Class of Recommendation in Table; drugs listed alphabetically.

SHD indicates structural heart disease (including ischemic heart disease).

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