Management of Supraventricular Tachycardia

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Normal sinus rhythm

Intracardiac tracings show the normal intervals between:

- initiation of atrial depolarization $A$
- His bundle activation $H$
- ventricular depolarization $V$

$AH + HV = PR$ interval
Mechanism of Arrhythmia

• Enhanced Automaticity
• After Depolarizations: Early (EAD), Delayed (DAD)
• Re-entry
Normal sinus rhythm

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- initiation of atrial depolarization $A$
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- ventricular depolarization $V$
- $AH + HV = PR$ interval
Enhanced Automaticity
After Depolarizations
Re-entry
Tachycardia

• Wide QRS: Mostly VT
• Narrow QRS: SVT
Tachycardia - Prognosis

- VT: Increased mortality
- SVT:
  - No impact on mortality
  - Excellent long term outcome
  - Can rarely cause tachycardia induced cardiomyopathy
Supraventricular Tachycardia

- Sinus Tachycardia
- AV Nodal Re-entrant Tachycardia
- Atrioventricular Re-entrant Tachycardia
- Atrial Flutter, Fibrillation
- Atrial Tachycardia
- Paroxysmal Junctional Tachycardia
Wide QRS Tachycardia

- Ventricular Tachycardia
- SVT with pre-existing bundle branch block
- Antidromic Atrioventricular Re-entrant Tachycardia with WPW syndrome
- SVT with Aberrant Conduction
AVNRT Mechanism
AVNRT Mechanism
AV Nodal Reentry Tachycardia (AVNRT)

AVNRT Dual AV node physiology
- both fast and slow conduction pathways are present in the AV node
- rapidly conducting tissue has a long recovery time
  - fast boat, long wake
- slow-conducting pathway has a relatively short recovery time
  - slow boats can follow more closely
AVNRT Normal Sinus Rhythm

During sinus beats
• conduction occurs via fast pathway
• conduction via slow pathway is blocked
AVNRT Sinus beat
- labeled S1

Premature Atrial Contraction (PAC)
- labeled S2
- blocked in fast pathway
- the slow pathway may permit reentry into the AV node
  - short recovery time
  - depolarizes both atria and ventricles
AV Nodal Reentrant Tachycardia

Retrograde P-waves in leads I, II, V1-V3
Atrio-ventricular Re-entry
Atrioventricular bypass tracts, or accessory pathways, can be found anywhere along the muscular portion of the posterior and lateral aspects of the mitral and tricuspid annuli. They can be classified by their anatomic location as either

- **right-sided**,  
- **left-sided**,  
- **posteroseptal**, or  
- **anteroseptal**.
ECG requirements for diagnosis of WPW syndrome
- P-R interval < 120 ms
- Normal P wave vector (to exclude junctional rhythm)
- Presence of a delta wave
- QRS duration > 100 ms
Supraventricular tachycardia
• can be initiated by a closely coupled premature atrial complex (PAC)
• blocks in the accessory pathway
• but conducts through the AV node
• retrograde conduction via accessory pathway
• inverted P wave produced by retrograde conduction visible in the inferior ECG leads
SVT: Emergency Management

- Valsalva maneuver, Carotid sinus massage.
- Adenosine 6 mg, 12 mg: given IV
- Diltiazem/Verapamil given IV: less effective, can cause hypotension,
- Electrical Cardioversion – if hemodynamically unstable. Should be done under anesthesia.
SVT: Long term Management

- No treatment for infrequent minimally symptomatic attacks.
- Medical management.
- Curative treatment – Radiofrequency Ablation
### Antiarrhythmic Drugs: Vaughn-Williams Classification

<table>
<thead>
<tr>
<th>Class</th>
<th>Action</th>
<th>Drug</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Sodium Channel Blockade</td>
<td>IA: Disopyramide, Quinidine</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Procainamide</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IB: Lidocaine, Mexiletine</td>
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<tr>
<td></td>
<td></td>
<td>IC: Flecainide, Propafenone</td>
</tr>
<tr>
<td>II</td>
<td>Beta Blockade</td>
<td>Metoprolol, Atenolol</td>
</tr>
<tr>
<td>III</td>
<td>Potassium Channel Blockade</td>
<td>Amiodarone, Sotalol</td>
</tr>
<tr>
<td>IV</td>
<td>Calcium Channel Blockade</td>
<td>Verapamil, Diltiazem</td>
</tr>
</tbody>
</table>
SVT: Medical Management

- Beta blocker
- Calcium Channel blockers
- Sotalol
- Class 1C drugs: Flecainide, Propafenone
  - Amiodarone should not be used
SVT: Medical Management

• Amiodarone – is an extremely toxic medicine and should be avoided for treatment of SVT
SVT: Radiofrequency Ablation

- Offers cure for SVT
- >90% success rate
- Low recurrence
Electrophysiology Laboratory
Femoral Venous Sheaths
Tip and Tissue Interaction in an RF Ablation System

Conductive heat transfer zone (non-destructive)
Small zone of resistive heating (lesion area)

Courtesy of John M. Miller, M.D.
Cutting diathermy

1 kV

High voltage pulses promote arcing and coagulation

4 ms

RF catheter ablation

40 V

Continuous low voltage causes resistive heating
AVNRT can be cured permanently with catheter ablation, using radio frequency to heat and destroy the cells in the slow pathway, creating a permanent line of block.
Radio frequency ablation of the accessory pathway is often indicated in patients with WPW who are at risk of sudden death due to atrial fibrillation with a rapid ventricular response via the bypass tract.

Note the disappearance of the preexcitation delta wave in the QRS with catheter ablation.
RIGHT SIDED AP ABLATION
Radiofrequency Ablation

• Dec 4, 2004: First radiofrequency ablation of WPW syndrome in Bangladesh.
Training - Outcome

- Developed a cardiac electrophysiology team at NICVD with 2 electrophysiologists, 2 nurses and 1 technician.
- They are capable of providing safe and effective electrophysiology service.
Training Outcome – The EP Team

• Performed over 1500 Radiofrequency ablations (12/2004 – 12/2010) of SVT, WPW syndrome and VT cases with more than 90% success rate.

• Implanted 50 Defibrillator.

• Presented 10 papers on electrophysiology at 2006 Annual meeting of the Japanese Circulation Society, European Society of Cradiac EP and national meetings.
Economic Impact

• Cost to patients:
  • Tk 30 lakh \( (2000 \times 1500) \),
  • US$ 44,117

• Cost if these patients had gone to India:
  • Tk 30 Cr. \( (200,000 \times 1500) \),
  • US$ 4,411,700 ($4.4 million)