Pediatric Arrhythmias

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Peter Aziz, MD
Pediatric Electrophysiologist

Objectives

- Understand arrhythmia epidemiology
- Recognize the typical clinical scenario for arrhythmia presentation
- Review common causes of sudden cardiac death
- Address pacemaker basics

Supra-ventricular Tachycardia

AV Node Dependent → AVNRT

AV Node Independent → Atrial Ectopic Tachycardia

AVRT → Atrial Flutter

→ Atrial Fibrillation
SVT Mechanisms

Re-entrant SVT
- Paroxysmal
- Fixed HR
- Fast HR
- Palpitations
- Vagal maneuvers successful
- Rare cause of cardiomyopathy

Atrial Ectopic SVT
- Incessant
- Variable HR
- Relatively slow
- Possibly no palpitations
- Vagal maneuvers unsuccessful
- Can cause cardiomyopathy

1 Day Old in NICU
Age Distribution at First Episode of SVT

Baursfeld, Eur J Pediatr 2001

Why Infants?

Hahurij, Circulation 2008

Natural History of SVT

“Early Disappearance-Late Recurrence”

Perry, JACC 1990
Acute SVT Treatment

- Adenosine
  - Run a rhythm strip
- Rate control
  - Esmolol
  - Avoid Ca\(^{2+}\) blockers in infants
- Cardioversion
  - In the unstable patient

14yo with Palpitations

- Sudden onset, sudden offset palpitations
- Lasts 10-20 minutes, occurs 2x per week
- Feels dizzy, lightheaded
- No syncope

ECG at PCPs Office
Wolff-Parkinson-White Syndrome

- Pathway with antegrade conduction →
  - 1) Short PR
  - 2) Wide QRS
  - 3) Delta wave
- Two clinical problems
  - SVT – not life-threatening
  - Sudden death (0.3-4.8%)
    - Rapid conduction of atrial tachycardia

Role of EP Study

Risk Stratification vs Restriction

Catheter Ablation

CURE!

During EP Study
Post-Ablation

17yo with Tachycardia

- Tachycardia noted during science class
- Echo showed depressed function
- No other cardiovascular symptoms

What’s the Problem?
13yo with Syncope

- Looking at herself in mirror
- School bell rings
- Unconscious for 2-3 minutes
- Wakes up in school nurse’s office disoriented
Her ECG

QTc = 478 ms

Long QT Syndrome

- Ion channelopathy causing SCD
  - AD inheritance
- Hallmark presentation:
  - Syncope – NO prodrome
- Hallmark arrhythmia:

Table 1: Diagnostic criteria LQTS-1993 Schwartz

<table>
<thead>
<tr>
<th>ECG findings</th>
<th>Points</th>
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</thead>
<tbody>
<tr>
<td>QTc &gt; 480 ms</td>
<td>3 points</td>
</tr>
<tr>
<td>460-479 ms (m)</td>
<td>2 points</td>
</tr>
<tr>
<td>450-499 ms (f)</td>
<td>1 point</td>
</tr>
<tr>
<td>T wave alternans</td>
<td>1 point</td>
</tr>
<tr>
<td>Notched T wave in three leads</td>
<td>1 point</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Clinical history</th>
<th>Points</th>
</tr>
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<tbody>
<tr>
<td>Syncope</td>
<td>2 points</td>
</tr>
<tr>
<td>Without stress</td>
<td>1 point</td>
</tr>
<tr>
<td>Congenital deafness</td>
<td>0.5 points</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Family history</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family members with definite LQTS</td>
<td>1 point</td>
</tr>
<tr>
<td>Unexplained sudden cardiac death below age 30 among immediate family members</td>
<td>0.5 point</td>
</tr>
</tbody>
</table>
Triggers in LQTS

Exercise Stress Testing

Back to Our Patient

- Family history
  - Mom with recurrent syncope
- EST
  - Mild QTc prolongation in recovery
- Genetic testing
  - Currently pending
- Patient treated with nadolol for presumed LQTS
10yo Male with Syncope, Family History of SCD

Brugada Syndrome

- Na⁺ ion channelopathy in SCN5A
- SCD during sleep
- Presentation:
  - Syncope
  - ECG abnormalities exacerbated by fever
- Treatment:
  - ICD
  - only proven intervention to decrease SCD

14yo with Syncope During Basketball
Hypertrophic Cardiomyopathy

- Asymmetric hypertrophy of septum
- Autosomal dominant
- Presentation:
  - Chest pain, dizziness, syncope
- Common cause of SCD
  - Arrhythmia
  - Obstruction

Management

- Patient scheduled for MRI
- Restricted from sports

Convinced to play in basketball tournament
Died on the court
16yo Postural Syncope

14yo with Syncope During IV Stick

Vasovagal Syncope

- Trigger related
  - Positional change
  - Hair combing
  - Micturation
  - After exercise
- Prodrome
  - Dizzy, lightheaded, tunnel vision
15mo with Poor Weight Gain

Complete Heart Block

• Most common indication for pediatric pacemaker
• Can be the result of maternal antibody exposure
  - At risk for ventricular dysfunction
• Most cases though are idiopathic

Epicardial Dual Chamber Pacemaker
Who Gets Pacemakers?

- Indications
  - Symptomatic bradycardia
  - Low average heart rates
  - Significant pauses
  - Ventricular dysfunction

Summary

- SVT is common in the pediatric patient
- Causes of SCD must be excluded in a patient with syncope
- History is often more useful than the ECG
- Pacing and ICDs are valuable tools in the pediatric population
- Not all arrhythmias are created equal