Update on Treatment of Ventricular Tachycardia

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Ventricular Tachycardia Therapy
Non-ICD Options

- Anti-arrhythmic Drug
- Catheter Ablation
- Do Nothing
Non-ICD VT Therapy
Specific Clinical / Arrhythmia Subgroups

- Idiopathic VT
  - Left bundle inferior axis
  - Right bundle superior axis
- “Benign” PVC’s
- Refractory VT and recurrent ICD shocks
  - Commonly ischemia mediated
Classification of Idiopathic Ventricular Tachycardia

Outflow Tract
- RVOT 70%
- LVOT

Fascicular
- LPF
- LAF

Annular
- MA
- TA

Adrenergic

Septal

10 to 20% VTs at Large EP Referral Centers
Idiopathic VT

Types: Outflow VT / Fascicular VT

By definition: No associated heart disease

Need to account for possible tachycardia cardiomyopathy

May have subtle RVOT abnormalities on MRI
Outflow Tract VT

70%-80% of Idiopathic VTs
More common in women
3rd to 5th decade
Arrhythmias – Left bundle inferior Axis
PVCs
Repetitive Monomorphic VT (RMVT)
Paroxysmal Exercise Induced SMVT
Exercise – reproduces VT in 25 to 50%
Clinical Presentation

- Salvos
- Palpitations
- Sustained tachycardia is not uncommon
- True syncope is infrequently seen
- Rarely life threatening
Outflow Tract VT

**RVOT – 60 to 80%  ** **LVOT – 10 to 15%**

Common Embryonic Origin
Catecholamine facilitated – cAMP, Ca+2 mediated
Triggered activity – DADs
Adenosine, Verapamil, Beta blocker, Vagal maneuvers

Rare locations – PAs, Ao cusp, Epicardial
Outflow Tract Tachycardia Regions

RV Inflow – Anterior TA
RVOT – Free Wall, Septal AoV Cusps
Endocardial LVOT
Epicardial LVOT
Aorto-Mitral Continuity
Superior Mitral Annulus
Outflow Tract VT

127 patients (Mean age = 51 yrs) evaluated for outflow tract arrhythmias.

<table>
<thead>
<tr>
<th>Index arrhythmia</th>
<th>SMVT</th>
<th>NSVT / PVCs</th>
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</thead>
<tbody>
<tr>
<td># Patients</td>
<td>36</td>
<td>91</td>
</tr>
<tr>
<td>SMVT at EPS</td>
<td>78%</td>
<td>26%</td>
</tr>
<tr>
<td>Catechol. needed</td>
<td>60%</td>
<td>75%</td>
</tr>
<tr>
<td>Adenosine effective</td>
<td>76%</td>
<td>100%</td>
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<tr>
<td>RVOT location</td>
<td>75%</td>
<td>85%</td>
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Conclusion: The arrhythmia subtypes represent a continuum of a similar mechanism with different levels of expression.

Kim et al, JACC 2007
RVOT VT
Outflow Tract VT – Therapy

Medical Therapy

Acute Termination
  Vagal Maneuvers
  Adenosine
  IV Verapamil
  Lidocaine

Oral Medical TX – 25 to 50% response
  1st line: Beta blockers, Calcium blockers
  2nd line: Sotalol, Flecainide
  Last: Amio, Class IAs
RVOT VT – Therapy

**Indications for Ablation**
- Medically Refractory
- Sustained VT
- Very Symptomatic
- Tachycardia Cardiomyopathy
- Younger Patients

**Mapping**
- Pace Mapping: want $\geq 11/12$ match
- Activation: -10 to 45 ms

90% Efficacy 10% Recurrence rate
Idiopathic VT
Ablation in RVOT
Differential Diagnosis of LBBB Morphology Tachycardia
Benign vs Malignant Arrhythmias

Benign
- RVOT / LVOT idiopathic VT
- WPW / Mahaim tachycardia

Malignant
- ARVD
- VT in Repaired Tetralogy of Fallot
- Bundle Branch Reentry – Dilated CM / IVCD
29 yo world class competitive athlete presented with palpitations after a workout
Differential Diagnosis of Left Bundle Morphology VT

**ARVD vs Idiopathic VT**

**Both:** Young pts, catecholamine facilitated, RMVT, SMVT, frequent PVCs

**ARVD:** Malignant VT – SCD
- Positive SAECG
- Right Precordial T wave abnormalities
- Multiple / Atypical VT morphologies
- Echo – RV WMAs
- MRI – Fatty changes, WMAs
ARVD Facts

First described in 1977.

Once thought to be rare, ARVD has been shown to have an incidence of six per 10,000 persons in certain populations.

In certain Mediterranean populations incidence is as high as 44 per 10,000 persons.

ARVD accounts for 3 to 4 percent of deaths in sports and 5 percent of sudden cardiac deaths in persons younger than 65 years.
ARVD: Disease’s Principle
pathology
Cardiac MRI
The 29 y.o. Athlete

1. Exercise induced LBSA Axis VT

2. Baseline ECG – right precordial T wave inversion

3. Family Hx SCD – Grandfather died @ 32 yo

4. Abnormal MRI

RV Dysplasia = Not a Benign arrhythmia
Idiopathic LV Fascicular Tachycardia

- Young pts: 15 to 40 yo
- Male predominance
- Verapamil sensitive
- Tachycardia CM, SCD rare
- May be facilitated by exercise
- Often misdiagnosed as SVT with aberration
- Morphology: RBBB/LAFB or LPFB
  - RB/LAFB (RBSA) Most common (90%)
  - Involves the Purkinje network
  - “Narrow” VT ≤ 150ms
45 yo M presented 4hrs after returning from his honeymoon. Coincidence?
Idiopathic LV VT – Proposed VT Circuit

Aiba et al, Pacing Clin Electrophys (24) 2002
Idiopathic LV VT
Fascicular LV VT

Diasstolic potentials and Purkinje potentials located along inferoseptal LV

Nogami et al. JACC 36 (3) 2000:811–23
Idiopathic LV fascicular VT

Medical therapy
IV /PO Verapamil

Targets for Ablation
During VT
Diastolic potentials – target the distal region to avoid CHB, LBBB.
Purkinje potentials – target earliest potential located at VT exit site.

NSR Mapping
Target LPF – endpoint is LPFB
Linear lesion line perpendicular to basal LV septum
Pace mapping – least effective

90% Success rates for RFA
Ablation Catheter Location on Fluoroscopy
Purkinje Potential Mapping

II

III

VI

RV

Abl

−40 msec
Idiopathic LV VT – Termination with RF
What About Recurrent ICD Shocks?

The device is working but the patient can’t take it
29 yo Wrestling Coach Working with his Team
Recurrent Tachycardia 1/21/08
Rx’d with ATP and Shocks

<table>
<thead>
<tr>
<th>Type</th>
<th>ATP Seq</th>
<th>Shocks</th>
<th>Success ID#</th>
<th>Date</th>
<th>Time hh:mm:ss</th>
<th>Duration hh:mm:ss</th>
<th>Avg bpm A/V</th>
<th>Max bpm A/V</th>
<th>Activity at Onset</th>
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<tbody>
<tr>
<td>FVT</td>
<td>1</td>
<td>3</td>
<td>Yes</td>
<td>6</td>
<td>21-Jan-2008</td>
<td>11:05</td>
<td>240/240</td>
<td>330 ms</td>
<td>V-V</td>
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- VF = 270 ms
- FVT = 240 ms
- VT = 330 ms

What Next?
VT Induced @ EPS
Isuprel infusion @ 6 ug/min
Fluoroscopy – Best Pace Map in RV apex
RFA Unsuccessful – What Next?
The Optimal Pharmacological Therapy in ICD Patients: OPTIC Trial

3 Treatment Arms: Amio + BB, Sotalol, BB
412 pts, 1 yr follow-up
Primary Endpoint: ICD shock for any reason

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<tr>
<th>Treatment</th>
<th>Shocks</th>
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<tr>
<td>Beta Blocker</td>
<td>38%</td>
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<tr>
<td>Sotalol</td>
<td>24%</td>
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<tr>
<td>Amio+BB</td>
<td>10%</td>
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*Conclusion: Amio+BB and sotalol reduce shocks vs. BB alone*

Connolly et al. JAMA. 2006
Major Advances in VT RFA Technology / Approaches

Large Tip (8mm) / Cool Tip technology
Nearly doubled lesion size (14 x 8mm)

3D Catheter Mapping technology

Epicardial Ablation

Remote Navigation: Stereotaxis
63 yo M with S/P IMI, EF = 40% with recurrent VT. VT Refractory to Amiodarone and Mexitin. and resistent to ATP therapy. (> 20 shocks)

VT @ CL = 360ms ATP x 5 followed by a 5 J shock
Initial LV Scar Map

RF lesions along scar border
Scar related VT RFA

**Hemodynamically stable VT**
70 to 80% success rate for ablation of clinical VT (> 90% if VT is incessent)

**Hemodynamically Unstable VTs**
Substrate Mapping / RFA achieves clinical control in approximately 75%
Conclusions

1. Some benign arrhythmias may cause significant Dz
2. Not all VT needs an ICD
3. RF ablation may be the preferred therapy for some VTs
4. Advances in RF technology have made VT RFA easier
5. Drug therapy may be needed along with ICD therapy
6. An evaluation for structural disease must be done before ablation
"Let me through, please-
I'm an herbalist!"