Ventricular Tachycardia: Therapy

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Ventricular Fibrillation – Sudden Cardiac Death
Lead aVL

150-J biphasic defibrillation
In Switzerland 10‘000 people die every year from sudden cardiac death
ICD = Implantable Cardioverter - Defibrillator
Ventricular Tachycardia – Sudden Cardiac Death

- Scar post MI
- Impaired systolic LV function
- Severe structural heart disease
Ventricular Tachycardia

Scar-related electrical Reentry circuit
Monomorphic versus polymorphic VT

Monomorphic VT
- No Structural Heart Disease / Idiopathic
- Scar-related
- Purkinje-related

ECG

ICD - A

ICD - V
Monomorphic versus polymorphic VT

**Monomorphic VT**
- No Structural Heart Disease / Idiopath
- Scar-related
- Purkinje-related

**Polymorphic VT**
- Acute myocardial ischemia
- Ventricular scar, hypertrophy, failure
- Genetic sudden death syndromes
  - Long QT, short QT
  - Brugada
  - CPVT
ICD = **Implantable Cardioverter - Defibrillator**
### Amiodarone

![Amiodarone](image)

<table>
<thead>
<tr>
<th>UAW/Organ</th>
<th>Inzidenz</th>
<th>Empfohlene Überwachung</th>
<th>Anmerkungen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herz</td>
<td></td>
<td>Ausgangs-EKG vor Therapiebeginn, mind. jährliche Kontrollen; bei vorbestehenden Überleitungsstörungen erwägen; Dosisreduktion oder Therapiestopp bei QT-Zeit &gt; 550 msec</td>
<td>Geringere Loading-Dose bei älteren Patienten und bei vorbestehenden Überleitungsstörungen erwägen; Dosisreduktion oder Therapiestopp bei QT-Zeit &gt; 550 msec</td>
</tr>
<tr>
<td>Bradykardie</td>
<td>5%</td>
<td></td>
<td>Nicht bei Patienten mit schwerer Lebererkrankung anwenden!</td>
</tr>
<tr>
<td>QT-Zeit-Verlängerung</td>
<td>&gt; 90%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Torsades de pointes</td>
<td>&lt; 1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leber</td>
<td>15%</td>
<td>SGOT (AST) und SGPT (ALT) vor Therapiebeginn bestimmen, Kontrollen alle sechs Monate</td>
<td></td>
</tr>
<tr>
<td>Schilddrüse</td>
<td></td>
<td>Schilddrüsenfunktionsstests vor Therapiebeginn, 2-3 Kontrollen jährlich</td>
<td>Nicht bei Patienten mit vorbestehenden Schilddrüsenknoten anwenden! Höhere Inzidenz von Funktionsstörungen bei Autoimmunerkrankungen der Schilddrüse</td>
</tr>
<tr>
<td>Hyperthyreose</td>
<td>3% (Jodmangelgeb. 20%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypothyreose</td>
<td>20%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunge</td>
<td>&lt; 3%</td>
<td>Lungenfunktionstest vor Therapiebeginn und wenn Symptome auftreten. Rö-Thorax vor Therapiebeginn und jährliche Kontrollen</td>
<td>Sofortiges Absetzen, wenn der Verdacht auf pulmonale UAW besteht</td>
</tr>
<tr>
<td>Haut</td>
<td>25-75%</td>
<td>Keine besonderen Überwachungsempfehlungen</td>
<td>Sonnenschutz, Sun-Blocker mit hohem Lichtschutzfaktor</td>
</tr>
<tr>
<td>(Photosensibilität, Hautverfärbung)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nervensystem</td>
<td></td>
<td>Keine besonderen Überwachungsempfehlungen</td>
<td>Bei verdächtigen Symptomen Dosisreduktion</td>
</tr>
<tr>
<td>Ataxie, Tremor, Schlafstör., Polyneuropathie</td>
<td>3-30%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Augen</td>
<td></td>
<td>Augenärztliche Untersuchung vor Therapiebeginn, Folgeuntersuchungen bei Symptomen</td>
<td>Nicht bei Pat. mit vorbestehender Neuritis N. optici</td>
</tr>
<tr>
<td>Hornhautablagerung</td>
<td>100%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neuritis N. optici</td>
<td>&lt; 1%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Patient 1
76-yo Male Patient

- Acute inferior MI and acute PCI of occluded RCA
- Hypertension
- Diabetes
- Severe lung disease post pleurectomy for pleural tuberculosis
Severe Kyphoskoliosis
5 Days Later….

Recurrent symptomatic WCT
Your ECG Diagnosis?

a) AF with aberrancy

b) Atrial tachycardia

c) Ventricular tachycardia

d) Dual tachycardia
ECG during normal SR
Sustained Tachycardias requiring DCCV
Sustained Tachycardias requiring DCCV
Problem

- Recurrent symptomatic sustained monomorphic VTs 180/min
What would you do next?

a) Echo

b) Coronary angiogram

c) EP study

d) Functional ischemia test and which type
Diagnostics

- Echo: EF 44%, hypo-/akinesia inferior, infero-lateral, infero-septal from basal to midventricular
- Repeated coronary angiogram and PCI of RCX
- Cardiac MRI: Infero-lateral scar from basal to apical, RVOT/LVOT normal
Coronary Angiography
Coronary Angiography
Treatments

- Betablocker
- Amiodarone
- Electrical cardioversions x3
Treatments

- Betablocker
- Amiodarone
- Electrical cardioversions x3
- In external hospital failed ablation for suspected „idiopathic“ RVOT VT
- Patient referred to our center
Myocardial Perfusion Scintigraphy

- No ischemia
- Large inferior and infero-lateral scar
Therapeutical Options in Refractory VT?

a) Add Lidocain

b) Renal sympathetic denervation (neuraxial modulation)

b) ICD

c) Assist device

d) Ablation
Drug Treatment

- Betablocker
- Amiodarone
- Lidocaine
Electrical Storm
Electrical Storm - Definitions

VT storm
≥3 separate episodes of sustained VT within 24h

Incessant VT
continuous sustained VT that recurs promptly despite repeated intervention for termination
Management of VT Storm

- Beta-blockade
- Antiarrhythmic drug therapy
- Intubation, deep sedation
- Mechanical hemodynamic support, i.e., IABP, LVAD
- Neuraxial modulation: thoracic epidural anesthesia, left stellate ganglionectomy
- Catheter ablation
Catheter Mapping and Ablation
Catheter Mapping and Ablation
Mapping Techniques for VT Ablation

Tung R et al. Circulation. 2011
Success Rate of VT Ablation

Scar

Subendocardial

Post myocardial infarction
Scar

**Subendocardial**

Post myocardial infarction

**Epicardial**

ARVC
Dilatative cardiomyopathy
Post myokarditis
Patient 2
55-yo Male Patient with ARVC
55-yo Male Patient with ARVC
55-yo Male Patient with ARVC
55-yo Male Patient with ARVC
Which Approach for VT Ablation?

a) Endocardial mapping / ablation first

a) Epicardial mapping / ablation only

b) Combined endo- and epicardial mapping / ablation

c) Don‘t know, perform coronary angiogram
How To Do “Dry Pericardial Puncture”?
Subxyphoidal Puncture for Epicardial Access
Needle for Dry Pericardial Puncture
Ablation Catheter in Pericardium
Epicardial Mapping
Ablation at Subtricuspidal Aneurysm (ARVC)
Device Interrogation at F/U (Sotalol off)

<table>
<thead>
<tr>
<th>VT/VF Counters</th>
<th>Prior Session 09-Dec-2014 to 12-Dec-2014</th>
<th>Last Session 12-Dec-2014 to 12-Jan-2015</th>
<th>Device Lifetime Total (Since 18-Jan-2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td>/F</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>VT</td>
<td>0</td>
<td>0</td>
<td>104</td>
</tr>
<tr>
<td>/T</td>
<td>0</td>
<td>0</td>
<td>191</td>
</tr>
<tr>
<td>Monitored VT (111 - 122 bpm)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>VT-NS (&gt;4 beats, &gt;122 bpm)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>High Rate-NS</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>PVC Runs (2-4 beats)</td>
<td>2.3 per hour</td>
<td>0.4 per hour</td>
<td></td>
</tr>
<tr>
<td>PVC Singles</td>
<td>5.9 per hour</td>
<td>7.2 per hour</td>
<td></td>
</tr>
<tr>
<td>Runs of VRS Paces</td>
<td>0.0 per hour</td>
<td>0.0 per hour</td>
<td></td>
</tr>
<tr>
<td>Single VRS Paces</td>
<td>0.0 per hour</td>
<td>0.0 per hour</td>
<td></td>
</tr>
</tbody>
</table>
Device Interrogation at F/U (Sotalol off)

Non-sustained VT episodes/day
Patient 3
53-yr Male Patient with Non-Ischemic CMP
53-yo Male Patient with Non-Ischemic CMP
Echo
Epicardial and Endocardial Mapping of Voltage
Late Potential in SR
Late Potential in SR
Substrate Mapping in SR of Voltage and LP
Epicardial and Endocardial Mapping of LP
Epicardial Mapping
3 VT Circuits
Avoid Coronary Arteries and Phrenic Nerve!
Avoid Coronary Arteries and Phrenic Nerve!
Perfect Pace Map induced VT 3
Ablation Site
Slowing during Ablation
Terminates and Reinduces
Definite Termination
Sinus Rhythm!
Thank you!
**Table 2** Indications for catheter ablation of ventricular tachycardia

**Patients with structural heart disease** (including prior MI, dilated cardiomyopathy, ARVC/D)

*Catheter ablation of VT is recommended*
1. for symptomatic sustained monomorphic VT (SMVT), including VT terminated by an ICD, that recurs despite antiarrhythmic drug therapy or when antiarrhythmic drugs are not tolerated or not desired; *
2. for control of incessant SMVT or VT storm that is not due to a transient reversible cause;
3. for patients with frequent PVCs, NSVTs, or VT that is presumed to cause ventricular dysfunction;
4. for bundle branch reentrant or interfascicular VTs;
5. for recurrent sustained polymorphic VT and VF that is refractory to antiarrhythmic therapy when there is a suspected trigger that can be targeted for ablation.

*Catheter ablation should be considered*
1. in patients who have one or more episodes of SMVT despite therapy with one of more Class I or III antiarrhythmic drugs; *
2. in patients with recurrent SMVT due to prior MI who have LV ejection fraction >0.30 and expectation for 1 year of survival, and is an acceptable alternative to amiodarone therapy; *
3. in patients with haemodynamically tolerated SMVT due to prior MI who have reasonably preserved LV ejection fraction (>0.35) even if they have not failed antiarrhythmic drug therapy.*

Aliot EM and Stevenson WG et al. Heart Rhythm 2009
Patients without structural heart disease

Catheter ablation of VT is recommended for patients with idiopathic VT
1. for monomorphic VT that is causing severe symptoms.
2. for monomorphic VT when antiarrhythmic drugs are not effective, not tolerated, or not desired.
3. for recurrent sustained polymorphic VT and VF (electrical storm) that is refractory to antiarrhythmic therapy when there is a suspected trigger that can be targeted for ablation.

VT catheter ablation is contra-indicated
1. in the presence of a mobile ventricular thrombus (epicardial ablation may be considered);
2. for asymptomatic PVCs and/or NSVT that are not suspected of causing or contributing to ventricular dysfunction;
3. for VT due to transient, reversible causes, such as acute ischaemia, hyperkalaemia, or drug-induced torsade de pointes.

Aliot EM and Stevenson WG et al. Heart Rhythm 2009