Prophylactic catheter ablation of VT in patients with structural heart disease: *Ready to reduce mortality?*

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Presenter Disclosure Information

Hans Kottkamp, M.D.
Within the past 12 months, the presenter or their spouse/partner have had a financial interest/arrangement or affiliation with the organization listed below.

<table>
<thead>
<tr>
<th>Company Name</th>
<th>Relationship</th>
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<tbody>
<tr>
<td>Biosense Webster</td>
<td>Consultant/Advisory Board Honoraria</td>
</tr>
<tr>
<td>St. Jude Medical</td>
<td>Consultant/Advisory Board Honoraria</td>
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</tbody>
</table>
What do the guidelines say for ICD implantation?

Class I

1. ICD therapy is indicated in patients who are survivors of cardiac arrest due to VF or hemodynamically unstable sustained VT after evaluation to define the cause of the event and to exclude any completely reversible causes. *(Level of Evidence: A)*\(^{16,319-324}\)

2. ICD therapy is indicated in patients with structural heart disease and spontaneous sustained VT, whether hemodynamically stable or unstable. *(Level of Evidence: B)*\(^{16,319-324}\)

3. ICD therapy is indicated in patients with syncope of undetermined origin with clinically relevant, hemodynamically significant sustained VT or VF induced at electrophysiological study. *(Level of Evidence: B)*\(^{16,322}\)

4. ICD therapy is indicated in patients with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III. *(Level of Evidence: A)*\(^{16,333}\)

5. ICD therapy is indicated in patients with nonischemic DCM who have an LVEF less than or equal to 35% and who are in NYHA functional Class II or III. *(Level of Evidence: B)*\(^{16,333,369,370}\)

6. ICD therapy is indicated in patients with LV dysfunction due to prior MI who are at least 40 days post-MI, have an LVEF less than or equal to 30%, and are in NYHA functional Class I. *(Level of Evidence: A)*\(^{16,332}\)

7. ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. *(Level of Evidence: B)*\(^{16,327,329}\)

Regardless of EF?
Regardless stable vs. unstable?
Prophylactic catheter ablation of VT in pts with structural heart disease

Prophylactic catheter ablation of VT in pts with structural heart disease: Ready to reduce mortality?

- Our current understanding of VT pathophysiology and the implications for catheter ablation
- Data from prospective randomized studies
- A short view back on the „famous“ ICD trials
- Future directions
Prophylactic catheter ablation of VT in pts with structural heart disease

The pathophysiology of VT post myocardial infarction

The model

Ventricle

Entrance

focal Ablation

Scan

Exit

The „reality“

focal Ablation

subepi

subendo
Electroanatomic mapping for ablation of VT post MI

• Mapping = Substrate description

• Ablation = Substrate modification
  - not only for stable „mappable“ VT;
  but also for

  - pleomorphic VTs
  - hemodynamically unstable VTs
  - nonreproducibly inducible VTs
Prophylactic catheter ablation of VT in pts with structural heart disease

Substrate mapping for VT ablation – Voltage map

Inferior view

MA

Septum

0.06 - 0.5 mV

0.5 - 0.8 mV

Free wall

Apex

1 cm

4.11 mV

0.06 mV
Inferior view

Septum

Free wall

MA

VT1

VT2

500 ms

CL 490 ms

CL 520 ms

0.06 - 0.5 mV

0.5 - 0.8 mV

I I I

II III

aVR aVL aVF

V1 V2 V3

V4 V5 V6

I I I

II III

aVR aVL aVF

V1 V2 V3

V4 V5 V6

L3744

L3744
Inferior view

Late potentials in the scar zone
Abl. LP
RV A
V1
V6
Abl.
RV A

Late potentials in the border zone
Abl. LP
RV A
V1
V6
Abl.
RV A

No potentials in „dense scar“
Abl.
RV A
V1
V6
Abl.
RV A

Septum
Free wall
Apex
MA

0.06 - 0.5 mV
0.5 - 0.8 mV

4.11 mV
0.06 mV

1 cm

L-3744
Prophylactic catheter ablation of VT in pts with structural heart disease

**Mapping = Substrate description**

- Chronic scar with surviving muscle fibers („central common pathway“, „isthmus“)
- Voltage map
- Sinus rhythmus map
- Pace map
- Limited activation map
Placement of linear lesion lines
Typically within the chronic infarction scar area
Typically perpendicular to the course of the central common pathways
Goal: complete noninducibility
Ablation of incessant/very frequent VT post MI: Results

- 50 patients; age 68 ± 7 years; EF 29 ± 15 %
- Pts with incessant or frequently recurrent VT

- Target area maps: 60 ± 33 mapping points
- Lesion line length: 46 ± 21 mm
- RF pulses: 17 ± 7
- Procedure time: 134 ± 41 min.
- Fluoroscopy time: 29 ± 15 min.

- 38/50 pts. (76 %) rendered completely noninducible
Prophylactic catheter ablation of VT in pts with structural heart disease

Ablation of incessant/very frequent VT post MI: Results

- Completely noninducible after ablation (Group I)
- Some type of VT still inducible after ablation (Group II)

Prophylactic catheter ablation of VT in pts with structural heart disease

The job of the ICD...
Prophylactic catheter ablation of VT in pts with structural heart disease

**SCD-HeFT**

*Amiodarone or ICD or Placebo in patients with heart failure*

Inclusion criteria:

- Symptomatic heart failure (not NYHA IV)
- EF ≤ 35%
- No risk stratification with nonsustained VTs

*Prespecified subgroups*

- *Ischemic vs. nonischemic CM*
- *NYHA II vs. NYHA III*

- N = 2521
- Age = 60 y.
- LVEF = 25%
- 70% NYHA II
- 30% NYHA III
- IDCM 52%
- NIDCM 48%
- FU 46 Mo.

Prophylactic catheter ablation of VT in pts with structural heart disease

**SCD-HeFT**
Time from ICD shock to death among patients who received at least one shock

<table>
<thead>
<tr>
<th>Type of Shock</th>
<th>All Patients</th>
<th>Patients Who Died</th>
<th>Time from Shock to Death</th>
<th>Kaplan–Meier Survival Rate 1 Year after Shock</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Median</td>
<td>Interquartile Range</td>
</tr>
<tr>
<td>Any shock</td>
<td>269</td>
<td>77</td>
<td>204</td>
<td>1–630</td>
</tr>
<tr>
<td>One or more inappropriate shocks only</td>
<td>87</td>
<td>10</td>
<td>294</td>
<td>28–509</td>
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<tr>
<td>One or more appropriate shocks</td>
<td>182</td>
<td>67</td>
<td>168</td>
<td>1–797</td>
</tr>
<tr>
<td>NYHA class II</td>
<td>117</td>
<td>31</td>
<td>206</td>
<td>1–977</td>
</tr>
<tr>
<td>NYHA class III</td>
<td>65</td>
<td>36</td>
<td>168</td>
<td>7–626</td>
</tr>
<tr>
<td>Ischemic heart failure</td>
<td>93</td>
<td>49</td>
<td>96</td>
<td>0–443</td>
</tr>
<tr>
<td>Nonischemic heart failure</td>
<td>89</td>
<td>18</td>
<td>622</td>
<td>204–908</td>
</tr>
<tr>
<td>First shock for ventricular fibrillation</td>
<td>77</td>
<td>33</td>
<td>3</td>
<td>0–622</td>
</tr>
<tr>
<td>First shock for ventricular tachycardia</td>
<td>105</td>
<td>34</td>
<td>258 &lt;9 mo.</td>
<td>59–797</td>
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</table>

Prophylactic catheter ablation of VT in pts with structural heart disease

Catheter ablation of VTs in pts with structural heart disease: Prospective multicenter studies “in the sickest pts”

- 231 pts (18 centers)
- CAD/MI, median EF 25%
- Recurrent VTs, several AAD, several ICD shocks

- After ablation: Complete non-inducibility in 49% of pts
- 7-days intervent.-mortality: 3% (bei 6/7 pts non-controllable VTs, 1/7 pts tamponade)

- 63 pts (8 centers)
- CAD/MI, median EF 28%
- Recurrent VTs, several AAD, several ICD shocks

- After ablation: Non-inducibility of clin. VTs in 81% of pts
- 30-days intervent.-mortalität: 0%, in 1 pt reanimation in prolonged VF episode

Prophylactic catheter ablation of VT in pts with structural heart disease

Catheter ablation of VTs in pts with structural heart disease: Prospective multicenter studies “in the sickest pts”

Prophylactic catheter ablation of VT in pts with structural heart disease

Catheter ablation of VTs in pts with structural heart disease: More aggressive: “Prophylactic”

Prospective multicenter randomized: Smash-VT

- 128 pts
- CAD/MI (mean EF 32%)
- Previous VT or VF
- No antiarrhythmic drug medication
- Randomization: ICD vs. ICD + ablation (substrate-modific.)
- Prim. endpoint:
  Survival free from any appropriate ICD therapy

Catheter ablation of VTs in pts with structural heart disease: More aggressive: “Prophylactic”
Prospective multicenter randomized: Smash-VT
Catheter ablation of VTs in pts with structural heart disease: More aggressive: “Prophylactic”

Prospective multicenter randomized: Smash-VT

<table>
<thead>
<tr>
<th>Variable</th>
<th>Ablation Group (N=64)</th>
<th>Control Group (N=64)</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICD events*</td>
<td>8 (12)</td>
<td>21 (33)</td>
<td>0.35 (0.15–0.78)</td>
<td>0.007†</td>
</tr>
<tr>
<td>ICD shocks</td>
<td>6 (9)</td>
<td>20 (31)</td>
<td>0.27 (0.11–0.67)</td>
<td>0.003‡</td>
</tr>
<tr>
<td>ICD storms</td>
<td>4 (6)</td>
<td>12 (19)</td>
<td>0.30 (0.09–1.00)</td>
<td>0.06‡</td>
</tr>
<tr>
<td>Death</td>
<td>6 (9)</td>
<td>11 (17)</td>
<td>0.59 (0.22–1.59)</td>
<td>0.29‡</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>3 (5)</td>
<td>6 (9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventricular tachycardia storm</td>
<td>0</td>
<td>1 (2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cancer</td>
<td>1 (2)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>1 (2)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>1 (2)</td>
<td>4 (6)</td>
<td></td>
<td></td>
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Prophylactic catheter ablation of VT in pts with structural heart disease

Randomized ICD-studies

- MADIT I 1996
- AVID 1997
- CABG-Patch 1997
- CASH 2000
- CIDS 2000
- MADIT II 2002
- DEFINITE 2004
- DINAMIT 2004
- SCD-Heft 2005
- IRIS 2009

ICD better

Primary prevention

Secondary prevention
What are the appropriate *endpoints & goals* for VT ablation in patients with structural heart disease?

- Ablation and noninducibility of the clinical VT (e.g. incessant VT)?
- Complete noninducibility of any VT?
- Curative?
- Noninferiority in mortality reduction compared to ICD?
Where do we go with ICD and VT ablation?

- It is clear that catheter ablation should be performed earlier in ICD patients in order to reduce ICD shocks.

- It is also clear that the time has come for randomized studies:
  - VTach II:
    - Stable VT
    - $EF > 30\%$
    - Randomization 1:1 Ablation vs. ICD
    - Combined endpoint
Prophylactic catheter ablation of VT in patients with structural heart disease:

*Ready to reduce mortality?*

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