CRT-P OR CRT-D ?

JJ BLANC

BREST UNIVERsITY
“Declaration of conflict of interest”

Saint Jude Medical
Medtronic
Sanofi Aventis
IT IS RELATIVELY EASY TO ANSWER

PROBABLY CRT-D

WHEN PATIENTS HAVE A CLASS I

INDICATION FOR SECONDARY ICD

IMPLANTATION (ABORTED SUDDEN

DEATH OR VT WITH SYNCOPE)
THE REAL QUESTION IS:

DO PATIENTS WITH A CLASS I INDICATION FOR CRT NEED A CRT-D IN PRIMARY PREVENTION?
Implantation rates of CRT-D and CRT-P per million inhabitants across Europe in 2006

Swedberg K et al. Eur J Heart Fail 2008;10:1229-1235
CRT-D AND CRT-P USE RELATIVE TO TOTAL CRT USE BY PRACTICE IN US

Predictors of CRT-P Compared with CRT-D Use

- Advancing age and female sex independently associated with greater use of CRT-P.
- CRT-P implantation was lower in multispecialty clinic compared with single-specialty clinic.
- Practices associated with a device clinic were more likely to use CRT-P.

### Odds ratio with 95% CI

- **Age (10 year)**
  - Odds ratio: 1.64

- **Male vs. female**
  - Odds ratio: 0.57

- **Myocardial infarc.**

- **CABG**

- **HF clinic**

- **Device clinic**

- **Multispecialty**

- **Annual patients per 500**

- **ß-Blocker use**

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INDICATIONS FOR CRT

2010 Focused Update of ESC guidelines on device therapy in heart failure

An update of the 2008 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure and the 2007 ESC guidelines for cardiac and resynchronization therapy

Developed with the special contribution of the Heart Failure Association and the European Heart Rhythm Association

Authors/Task Force Members, Kenneth Dickstein (Chairperson) (Norway)*, Panos E. Vardas (Chairperson) (Greece)*, Angelo Auricchio (Switzerland), Jean-Claude Daubert (France), Cecilia Linde (Sweden), John McMurray (UK), Piotr Ponikowski (Poland), Silvia Giuliana Priori (Italy), Richard Sutton (UK), Dirk J. van Veldhuisen (Netherlands)

ESC Committee for Practice Guidelines (CPG), Alec Vahanian (Chairperson) (France), Angelo Auricchio (Switzerland), Jeroen Bax (The Netherlands), Claudio Ceconi (Italy), Veronica Dean (France), Gerasimos Filippatos (Greece), Christian Funck-Brentano (France), Richard Hobbs (UK), Peter Kearney (Ireland), Theresa McDonagh (UK), Bogdan A. Popescu (Romania), Zeljko Reiner (Croatia), Udo Sechtem (Germany), Per Anton Sirnes (Norway), Michal Tendera (Poland), Panos Vardas (Greece), Petr Widimsky (Czech Republic)

Document Reviewers, Michal Tendera (CPG Review Coordinator) (Poland), Stefan D. Anker (Germany), Jean-Jacques Blanc (France), Maurizio Gasparini (Italy), Arno W. Hoes (Netherlands), Carsten W. Israel (Germany), Zbigniew Kalarus (Poland), Bela Merkely (Hungary), Karl Swedberg (Sweden), A. John Camm (UK)
RECOMMENDATIONS FOR NYHA III/IV PATIENTS

<table>
<thead>
<tr>
<th>Patient population</th>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYHA function class III/IV</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>LVEF $\leq 35%$, QRS $\geq 120$ ms, SR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal medical therapy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class IV patients should be ambulatory&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# RECOMMENDATIONS FOR NYHA II PATIENTS

<table>
<thead>
<tr>
<th>Patient population</th>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYHA function class II</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>LVEF $\leq 35%$, QRS $\geq 150$ ms, SR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optimal medical therapy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
INDICATIONS FOR ICD

ACC/AHA/ESC 2006 guidelines for management of patients with ventricular arrhythmias and the prevention of sudden cardiac death—executive summary

A report of the American College of Cardiology/American Heart Association Task Force and the European Society of Cardiology Committee for Practice Guidelines (Writing Committee to Develop Guidelines for Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death) Developed in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society
INDICATIONS FOR ICD

PATIENTS WITH ISCHEMIC HEART DISEASE, NYHA CLASS II OR III AND LVEF < 30% AT LEAST 40 DAYS AFTER MI

PATIENTS WITH DILATED CARDIOMYOPATHY, NYHA CLASS II OR III AND LVEF < 30%
THESE INDICATIONS ARE MAINLY BASED ON TWO TRIALS THAT COMPARED MORTALITY IN PATIENTS WITH ICM AND IN PATIENTS WITH CHF
MADIT II

P = 0.007

No. of patients (probability of survival)

Defibrillator: 742
Conventional: 490

503 (0.91) 274 (0.84) 110 (0.78)
329 (0.90) 170 (0.78) 65 (0.69)

Moss et al. NEJM 2002
Kaplan-Meier Estimates of Death from Any Cause

IT SEEMS THAT THERE IS A MAJOR OVERLAP BETWEEN CRT P AND D INDICATIONS

LVEF BETWEEN 30% AND 35%
BUT IS THIS OVERLAP OVERESTIMATED LEADING TO OVERUSE CRT-D AND UNDERUSE CRT-P?
IT IS EVIDENT THAT QUALITY OF LIFE COULD NOT BE BETTER WITH A CRT D THAN WITH A CRT P (CERTAINLY THE OPPOSITE). THEREFORE THE ONLY POTENTIAL ADVANTAGE OF CRT D OVER CRT P IS THE REDUCTION OF MORTALITY.
IN SCD-HEFT PATIENTS IN NYHA CLASS IV ARE EXCLUDED

PROPORTION OF PATIENTS NYHA CLASS IV INCLUDED IN MAJOR STUDIES ON CRT

<table>
<thead>
<tr>
<th>Study</th>
<th>No. pts</th>
<th>NYHA class IV</th>
<th>QRS (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIRACLE</td>
<td>453</td>
<td>10%</td>
<td>167±21</td>
</tr>
<tr>
<td>PATH CHF</td>
<td>41</td>
<td>16%</td>
<td>174±30</td>
</tr>
<tr>
<td>CONTAK CD</td>
<td>227</td>
<td>8%</td>
<td>160±27</td>
</tr>
<tr>
<td>COMPANION</td>
<td>1520</td>
<td>13%</td>
<td>160</td>
</tr>
<tr>
<td>CARE HF</td>
<td>814</td>
<td>6%</td>
<td>160 (152-180)</td>
</tr>
</tbody>
</table>
### ICD vs. Placebo Hazard Ratios

<table>
<thead>
<tr>
<th>Patient Group</th>
<th>N</th>
<th>HR</th>
<th>97.5% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Patients</td>
<td>1676</td>
<td>0.77</td>
<td>0.62, 0.96</td>
</tr>
<tr>
<td>NYHA Class</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class II</td>
<td>1160</td>
<td>0.54</td>
<td>0.40, 0.74</td>
</tr>
<tr>
<td>Class III</td>
<td>516</td>
<td>1.16</td>
<td>0.84, 1.61</td>
</tr>
<tr>
<td>CHF Etiology</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ischemic</td>
<td>884</td>
<td>0.79</td>
<td>0.60, 1.04</td>
</tr>
<tr>
<td>Non-Ischemic</td>
<td>792</td>
<td>0.73</td>
<td>0.50, 1.04</td>
</tr>
</tbody>
</table>

PATIENTS IN NYHA CLASS IV AND CLASS III IN THE SCD-HeFT TRIAL HAD NO DEMONSTRATED BENEFIT FROM ICD
BUT INDICATIONS FOR CRT INCLUDE MAINLY PATIENTS IN NYHA CLASS III/IV
Overall survival and freedom from arrhythmic death in patients under 75 years of age (A, C), and 75 years or older (B, D) (pooled data)

BUT INDICATIONS FOR CRT INCLUDE MANY OLDER PATIENTS

<table>
<thead>
<tr>
<th></th>
<th>SCD-HeFT</th>
<th>CARE HF</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE (YEAR)</td>
<td>60</td>
<td>67</td>
</tr>
<tr>
<td>FEMALES(%)</td>
<td>23</td>
<td>26</td>
</tr>
</tbody>
</table>
IN OLDER PATIENTS THE SURVIVAL BENEFIT OF CRT–D VS CRT-P IS AT MOST VERY LIMITED
MADIT II

Defibrillator Group

Conventional Group

P = 0.007

Moss et al. NEJM 2002
SCD-HeFT: Mortality

<table>
<thead>
<tr>
<th></th>
<th>HR</th>
<th>97.5% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amiodarone vs. Placebo</td>
<td>1.06</td>
<td>0.86-1.30</td>
<td>0.529</td>
</tr>
<tr>
<td>ICD Therapy vs. Placebo</td>
<td>0.77</td>
<td>0.62-0.96</td>
<td>0.007</td>
</tr>
</tbody>
</table>

BUT AFTER 12-18 MONTHS MANY CRT-P PATIENTS HAVE NO LONGER RECOMMENDED CRITERIA FOR ICD
Time course of changes in echocardiographic estimates of ejection fraction in the CRT-ON and CRT-OFF groups

REVERSE TRIAL

FINALLY ICD IS USELESS DURING THE FIRST 18 MONTHS AFTER IMPLANTATION AND NO LONGER INDICATED IN MORE THAN HALF OF THE PATIENTS AFTER THIS DELAY!
EF>30%.... IT IS NO LONGER AN INDICATION FOR ICD

PATIENTS REMAIN IN SEVERE CHF AND WILL DIED ....RAPIDLY!.....WHY NOT SUDDENLY

“RESPONDER” PATIENT

NON“REPONDER” PATIENT
### MEDIAN TIME FROM APPROPRIATE 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>
</tr>
</thead>
<tbody>
<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>
</tr>
<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</td>
<td>59–797</td>
</tr>
</tbody>
</table>

* Plus–minus values are survival rates ±SE. ICD denotes implantable cardioverter–defibrillator, and NYHA New York Heart Association.
**MEDIAN TIME FROM APPROPRIATE 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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>Interquartile Range</td>
<td>Full Range</td>
<td>%</td>
</tr>
<tr>
<td>Any shock</td>
<td>269</td>
<td>204</td>
<td>0–1872</td>
<td>82.5±2.4</td>
</tr>
<tr>
<td>One or more inappropriate shocks only</td>
<td>87</td>
<td>294</td>
<td>0–735</td>
<td>94.9±2.5</td>
</tr>
<tr>
<td>One or more appropriate shocks</td>
<td>182</td>
<td>168</td>
<td>0–1872</td>
<td>76.9±3.2</td>
</tr>
<tr>
<td>NYHA class II</td>
<td>117</td>
<td>206</td>
<td>0–1872</td>
<td>84.0±3.5</td>
</tr>
<tr>
<td>NYHA class III</td>
<td>65</td>
<td>168</td>
<td>0–1343</td>
<td>64.2±6.1</td>
</tr>
<tr>
<td>Ischemic heart failure</td>
<td>93</td>
<td>96</td>
<td>0–1872</td>
<td>62.6±5.2</td>
</tr>
<tr>
<td>Nonischemic heart failure</td>
<td>89</td>
<td>622</td>
<td>1–1785</td>
<td>91.6±3.0</td>
</tr>
<tr>
<td>First shock for ventricular fibrillation</td>
<td>77</td>
<td>33</td>
<td>0–622</td>
<td>74.6±5.0</td>
</tr>
<tr>
<td>First shock for ventricular tachycardia</td>
<td>105</td>
<td>34</td>
<td>0–1785</td>
<td>78.5±4.2</td>
</tr>
</tbody>
</table>

* Plus–minus values are survival rates ±SE. ICD denotes implantable cardioverter–defibrillator, and NYHA New York Heart Association.
THE REAL LIFE

716 PTS FU
25±19 MONTHS

141 (20%) DIED

3 (2%) ?
17 (12%) SUDDEN

86 (61%) CHF
27 (19%) VARIOUS

14 (10%) CRT D
3 (2%) CRT P

VAN BOMMEL et al Eur Heart J 2010;31,2783
OVERALL SURVIVAL BY DEVICE TYPE (ALTITUDE REGISTRY)

Saxon et al circulation 2010; 122: 2359
FINALLY
CRT-D IS NOT USEFUL IN PATIENTS WITH CRT BUT AS THE DEVICE IS AVAILABLE WHY NOT USE IT?
OK..... BUT THE DELETERIOUS EFFECTS OF CRT ARE MORE FREQUENT AND SERIOUS WITH A D THAN WITH A P
Annual Rate of Transvenous Defibrillation Lead Defects in Implantable Cardioverter-Defibrillators Over a Period of >10 Years

990 pts with a first AICD implantation between 1992-2005
INAPPROPRIATE SHOCKS
INAPPROPRIATE SHOCKS

A

Probability of Inappropriate Shock

Years from Implantation

PATIENTS AT RISK
Total 719
436 (0.10) 224 (0.13) 86 (0.15)

B

Probability of Inappropriate Therapy

Years from Implantation

PATIENTS AT RISK
Total 719
429 (0.12) 218 (0.15) 81 (0.19)
AN INAPPROPRIATE ICD SHOCK, AS COMPARED WITH NO INAPPROPRIATE SHOCK, WAS ASSOCIATED WITH A SIGNIFICANT INCREASE IN THE RISK OF DEATH (P=0.002).

POOLE NEJM 2008;359:1009
MULTIVARIATE MODEL OF HRs FOR RISK OF DEATH WITH AND WITHOUT A SHOCK FOR CRT D (ALTITUDE REGISTRY)

- Any Shock: 2.14 (1.79-2.55)
- One or more Appropriate Shock: 2.51 (2.01-3.14)
- One or more Inappropriate Shock: 1.60 (1.15-2.23)
- Both Appropriate and Inappropriate: 2.09 (1.21-3.60)

Saxon et al circulation 2010; 122: 2359
FINALLY CRT D IS A LIFE SAVING DEVICE

EXCEPT WHEN IT DELIVERS SHOCKS!
303 PATIENTS IMPLANTED WITH A CRT FOR A RECOGNIZED INDICATION FOLLOWED FOR 31± 19 MONTHS TO:

EVALUATE THE PREVALENCE

ESTABLISH THE FACTORS PREDICTIVE OF DEVICE INFECTIONS

ROMEYER ET AL EHJ 2010; 31:203
infections

13
4.3%
290

ROMEYER ET AL EHJ 2010; 31:203
INFECTIONS IN CRT D AND CRT P PATIENTS (upgrading excluded)

<table>
<thead>
<tr>
<th>CRT D</th>
<th>CRT P</th>
</tr>
</thead>
<tbody>
<tr>
<td>116</td>
<td>123</td>
</tr>
<tr>
<td><strong>8.6%</strong></td>
<td><strong>1.6%</strong></td>
</tr>
</tbody>
</table>

P <0.03

ROMEYER ET AL EHJ 2010; 31:203
<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>JOURNAL</th>
<th>YEAR</th>
<th>NUMBER</th>
<th>MAJOR COMPLIC.</th>
<th>DEATH</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALVAGNA</td>
<td>EUROPACE</td>
<td>2009</td>
<td>300</td>
<td>1(0.4%)</td>
<td>0</td>
</tr>
<tr>
<td>TARAKJI</td>
<td>HEART RHYTHM</td>
<td>2010</td>
<td>412</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>KENNERGREN</td>
<td>EUROPACE</td>
<td>2009</td>
<td>1032</td>
<td>10(0.9%)</td>
<td>0</td>
</tr>
<tr>
<td>BONGIORNI</td>
<td>EUR HEART J</td>
<td>2008</td>
<td>2062</td>
<td>15(0.7%)</td>
<td>3</td>
</tr>
<tr>
<td>JONES</td>
<td>HEART RHYTHM</td>
<td>2008</td>
<td>975</td>
<td>2(0.4%)</td>
<td>0</td>
</tr>
<tr>
<td>SAAD</td>
<td>PACE</td>
<td>2003</td>
<td>161(ICD)</td>
<td>2(1.2%)</td>
<td>1</td>
</tr>
</tbody>
</table>
CRT-D IS MUCH MORE EXPENSIVE THAN CRT-P!

<table>
<thead>
<tr>
<th></th>
<th>CRT-D</th>
<th>CRT-P</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEVICE</td>
<td>14075</td>
<td>3791</td>
</tr>
<tr>
<td>ELECTRODES</td>
<td>2737</td>
<td>1827</td>
</tr>
<tr>
<td>TOTAL</td>
<td>16812</td>
<td>5618</td>
</tr>
</tbody>
</table>

11194 EUROS (x3)
CRT-D HAS A REDUCED LONGEVITY COMPARED TO CRT-P!

25% LESS? (1 OR 2 YEARS)

MORE REPLACEMENTS AND MORE INFECTIONS
THERE IS NO DIRECT COMPARISON ON MORTALITY BETWEEN CRT D AND CRT P
COMPANION

TIME TO ALL CAUSES DEATH

CRT vs. OPT: RR = 24%, p=0.059 (Adjusted p-value = 0.060)
CRT-D vs. OPT: RR = 36%, p=0.003 (Adjusted p-value = 0.004)

OPT
CRT HR 0.76 (CI: 0.58-1.01)
CRT-D HR 0.64 (CI: 0.48-0.86)

12-month Event Rates
OPT: 19%
CRT: 15% (AR=4%)
CRT-D: 12% (AR=7%)

## RECOMMENDATIONS IN PATIENTS NYHA III/IV

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Patient population</th>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT-P/CRT-D is recommended to reduce morbidity and mortality&lt;sup&gt;d&lt;/sup&gt;</td>
<td>NYHA function class III/IV, LVEF ≤35%, QRS ≥120 ms, SR, Optimal medical therapy, Class IV patients should be ambulatory&lt;sup&gt;a&lt;/sup&gt;</td>
<td>I</td>
<td>A</td>
</tr>
</tbody>
</table>

<sup>a</sup> Evidence level

<sup>b</sup> Recommendation strength

<sup>d</sup> According to ESC Guidelines 2013
CRT INDICATION

HEART TRANSPLANT

CRT D

NO FACTORS ≠ DAI

CRT D

NO HEART TRANSPLANT

REMODELING DOUBTFUL

FACTORS ≠ * DAI

CRT P

REMODELING° LIKELY

CRT P

° NIDCM, women, wide LBBB, marked dissynchrony......

* NYHA IV, renal failure, very low EF, >75 years.....
CONCLUSION

IMPROVE THE QUALITY OF LIFE OF YOUR PATIENTS WITH A CRT-P
DO NOT DETERIORATE THEIR QUALITY OF DEATH (AND NOT ONLY) WITH A CRT-D