Primary and Secondary Prevention Implantable Cardiac Defibrillator Patients Have Similar Proportions of Ventricular Tachyarrhythmia Detections and Equivalent Risk for Spurious Therapies: Results From PainFREE Rx II

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Background: ICDs reduce mortality in primary (Prim) and secondary (Second) prevention pts. However, "overtreatment" in Prim remains a concern, potentially at the cost of spurious therapies for inappropriate ventricular detections due to SVT. We compared appropriate and inappropriate ventricular detections in 584 pts (Prim = 202, 35%; Sec- ond = 382, 65%) in PainFREE Rx II, a prospective randomized study of antitachycardia pacing (ATP) or shocks for fast VT (FVT).

Methods: All ICDs were identically programmed at implant with 3 zones (VT < 188 bpm; FVT = 188-250 bpm; VF > 250 bpm) but with either ATP or shock for FVT. An expert panel adjudicated all detected episodes that had stored electrograms. GEE methods were used to account for multiple episodes/pt and are reflected in percentages and p-values.

Results: Prim pts were significantly older, had lower HF and more CAD. Gender, b-blockers, antiarrhythmic drugs, and length of follow-up were similar between groups. During follow-up of 11 ± 3 months, 1670 ventricular episodes were detected as: 738 VT, 391 FVT, 123 VF, and 418 SVT. The distribution of VT, FVT, and VF was similar between Prim vs Second (VT: 99/276 [44%] vs 63/976 [6%]; p=0.77; FVT: 138/276 [41%] vs 253/976 [39%]; p=0.71; VF: 39/276 [15%] vs 84/976 [14%]; p=0.86). Proportion of pts with ≥1 appropriate episode was similar in Prim vs Second (21% vs 27%; p=0.13). But among pts with appropriate episodes, the median number of episodes per pt was significantly lower for Prim than for Second (1 vs 3, p=0.05). The proportion of pts with ≥1 inappropriate episode was similar in Prim vs Second (16% vs 15%, p=0.81), and the proportion of inappropriate episodes was greater in Prim but the difference was not significant (Prim, 121/397 [42%] vs Second, 297/1273 [34%], p<0.21).

Conclusions: Similar proportions of Prim and Second pts have appropriate detections for potentially life-threatening VT, FVT and VF but with less frequency in Prim. Inappropriate detections account for more than one-third of all ventricular episodes in both groups. Prim pts do not appear to be "overtreated" compared to Second pts and are at equivalent risk for spurious therapies.

Syncpe in Implantable Cardiac Defibrillator Patients: Predictors and Outcomes

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Background: The ability of ICD to terminate ventricular tachyarrhythmias and to reduce the rate of sudden death is well established. However, syncpe may still occur and impact quality of life and survival. The purpose of this study was to identify predictors of syncpe development in patients with ICD therapy using clinical and electrophysiological characteristics.

Methods: We retrospectively reviewed a prospectively collected ICD database of 309 pts with primary ICD implants at our institution between 1999 and 2002. 139 pts developed ICD therapy during a mean follow-up period of 21.7±11.6 months. There were 108 males and 31 females (av. age 65.2±11.8) with the following presenting arrhythmias: 56 (40.3%) sustained monomorphic ventricular tachycardia (MVT); 19 (13.7%) ventricular fibrillation (VF), 44 (31.7%) non-sustained ventricular tachycardia (NSVT); and 20 (14.4%) syncpe. Groups of pts with syncpe during ICD therapy and without syncpe were compared for clinical and electrophysiological variables and outcomes.

Results:

<table>
<thead>
<tr>
<th>Variables</th>
<th>Syncpe n=39</th>
<th>No Syncpe n=109</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>65.3±10.8</td>
<td>63.6±12.5</td>
<td>0.463</td>
</tr>
<tr>
<td>Gender M/F</td>
<td>23/7</td>
<td>85/24</td>
<td></td>
</tr>
<tr>
<td>Lowest EF %</td>
<td>23.1±15.6</td>
<td>30.7±16.8</td>
<td>0.05*</td>
</tr>
<tr>
<td>Inducible VT (%)</td>
<td>15 (50%)</td>
<td>77 (70.6%)</td>
<td>0.05*</td>
</tr>
<tr>
<td>Ischemic Heart Disease</td>
<td>21 (70%)</td>
<td>74 (67.9%)</td>
<td>0.83</td>
</tr>
<tr>
<td>ICD treated VT cycle (ms)</td>
<td>237.5±50.1</td>
<td>309.3±32.55</td>
<td>0.001*</td>
</tr>
<tr>
<td>More than 1 shock of ICD</td>
<td>5 (16.7%)</td>
<td>29 (26.6%)</td>
<td>0.22</td>
</tr>
<tr>
<td>ICD proarrhythmia %</td>
<td>5 (16.7%)</td>
<td>7 (6.4%)</td>
<td>0.05*</td>
</tr>
<tr>
<td>Syncpe at presentation %</td>
<td>18 (60%)</td>
<td>42 (38.5%)</td>
<td>0.042*</td>
</tr>
<tr>
<td>Mortality</td>
<td>11 (36.7%)</td>
<td>19 (17.4%)</td>
<td>0.05*</td>
</tr>
<tr>
<td>Mortality in less than 6 months</td>
<td>2 (11.8%)</td>
<td>6 (19.3%)</td>
<td>0.42</td>
</tr>
</tbody>
</table>

*p<0.05

Conclusions: Syncpe is not uncommon at the time of ICD device therapy and occurs in order patients with more depressed EF. Patients with syncpe during ICD therapy are more likely to have syncpe at presentation. ICD related proarrhythmia occurs more frequently, and the rate of ICD treated VT is faster in patients with syncpe. The total mortality also appears to be greater in ICD patients who experience syncpe at the time of device therapy.
less than 10 % ventricular ectopy. For HRV analysis standard time- and frequency parameters as well as nonlinear dynamic measures were calculated. To determine the time-frequency domain we calculated all HRV parameter for successive 5 minutes intervals up to 90 minutes before the onset of VTA.

Results: The mean RR-interval for VTA was significantly lower than for the controls (752.4±13.9 vs. 819.9±8.1, p=0.001). Whereas the number of ventricular premature beats (VPBs) was higher (230.5±19.7 vs. 147±10.5, p=0.0001), Heart rate and ventricular ectopy rate significant increase already 90 minutes before VTA onset compared with control conditions suggesting a state of sympathetic excitation. Mean heart rate and the number of VPBs were statistically significant for all comparisons. The symbol dynamic parameter POLVAR10 in addition detected a further sympathetic excitation 10 minutes before the onset of VTA, whereas all other parameters failed to detect these changes.

Stepwise discriminant function analysis gave a classification rate between VTA and control series of 71.7 % with a positive predictive accuracy of 51.4 % and a negative predictive accuracy of 88.3 %.

CONCLUSIONS: First results of this study suggest, that monitoring of heart rate dynam- ics in ICD patients can predict VTA events with a positive accuracy for VTA of about 50%.

Heart Rate Variability Footprint: New Diagnostic Tool to Monitor the Clinical Benefit of Cardiac Resynchronization Therapy in Patients With End-Stage Heart Failure

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Introduction: Heart rate variability (HRV) is a noninvasive measure of cardiac autonomic control. Decreased HRV is an independent risk factor in patients with chronic heart-fail- ure (HF). Cardiac resynchronization therapy (CRT) improves functional capacity and reduces morbidity in end-stage HF patients. We hypothesized that changes in symptoms and functional status of CRT HF patients as a result of CRT are reflected as a change in autonomic output and are displayed by HRV. We studied HRV “footprints” after ICD implantation and 6 months later obtained with a novel patient diagnostic tool available in the dedicated biventricular defibrillator (Renewal, Guidant, MN, USA) in patients with class III-IV heart failure.

Methods: Between July 2001 and May 2002, Renewal ICDs were implanted in 91 patients. Twenty-seven patients were excluded from the HRV-study because of atrial fibrillation and/or atrial pacing. Of the remaining 64 patients footprints of HRV were mea- sured as percentage of square root plot (X-axis heart rate, Y-axis RR-variability) on the third day after implantation and 6 months later. Correlations were made with the Min- nesota quality-of-life (QOL) score and 6-minute-walking test.

Results: Comparison between the baseline plot and the 6-month plot showed improve- ment in HRV in 46 patients (71 %) and the footprint percentage increased with 22 ±12 % (min 10 %, max 52 % improvement). In 18 patients (28 %) no improvement was seen. The improvement and deterioration obtained with the patient diagnostic tool correlated significantly with the improvement or deterioration in QOL score (n=0.681, p=0.05) and 6- MWT (n=0.581, p=0.004).

Conclusion: A significant correlation was found between HRV changes and changes in QOL and 6-minute-walking test. The novel patient diagnostic tool allows to obtain HRV footprints and could be used to monitor heart failure patients treated with resynchronisa- tion therapy.

The Implantable Defibrillator and the Long QT Syndrome: An Overview of Current Use and Outcome

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The use of the implantable cardioverter-defibrillator (ICD) in the long QT syndrome (LQTS) presents specific complexities (young age, stress-induced events, efficacy of antidysrhythmic therapy). The European LQTS-ICD Registry is an ongoing project which enrolls LQTS pts with an ICD to analyze current criteria for implant and to assess out- come. While there is a consensus to implant cardiac arrest (CA) survivors, other indica- tions are controversial. So far, 90 pts (81% females, QTc 514±59 ms, 37 % of known genotype) were enrolled. Before implant 98% were symptomatic, CA had occurred in 50% (80% of these pts before β-blockers (BB) therapy). However, 43 pts (48%) had only syncpe: 69% of them despite BB and 31% without therapy. During a 2.8±3.5 years mean follow-up, appropriate shocks occurred in 19 % while inappropriate shocks were received by 7 % of the pts. A replacement (13%) or repositioning (10%) had to be per- formed in 23% of pts while 7% received multiple repetitive discharges, average over 50 shocks/pt. In the appropriate shocks, 73% occurred in pts with prior CA, conversely, only 9% of the pts with (n=43) or without (n=2) syncpe independently of BB had appropri- ate shocks. Of the pts not on BB therapy prior to implant, 23% remained without therapy. In conclusion, ICD implant appears useful in pts with a prior CA, but in pts with syncpe only the rate of shocks is low. The Registry registered an important pitfalls in current manage- ment of LQTS: many pts receive an ICD just because of syncpe or of family history and are exposed to significant complications, while others are left without anti-arrhythmic pro- tection after implant. With LQTS pts, the ICD needs to be complemented by effective antidysrhythmic therapy to minimize the risk of shocks, even when appropriate.

Atrial Antitachycardia Pacing Efficacy Based on Time and Rhythm

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Background: Atrial antitachycardia pacing (ATP) has been incorporated into implanted devices in an effort to provide painless therapy for atrial tachycardia, flutter and fibrilla- tion. Controversy exists as to which atrial tachyarrhythmias (AT) are susceptible to ATP therapy as well as appropriate calculations of efficacy with respect to time post therapy.

Methods: This study looked at the efficacy of atrial ATP on AT episodes from patients implanted with an atrial and ventricular defibrillator (PRIZM AVT, Guidant Corp). Epis- odes receiving ATP were retrospectively classified as SVT, disorganized SVT (DSVT), or atrial fibrillation (Afib). Overall atrial ATP efficacy was calculated as well as efficacy within each classification. Efficacy as a function of time after therapy was also deter- mined.

Results: 293 episodes from 34 patients were included in the analysis. All patients were ICD indicated with a history of ≥1 atrial arrhythmia in the 12 months preceding implant.

Average age was 70±10 years, the majority of patients were NHYA class II with an aver- age LVEF of 34±14%. 147 episodes (50%) were classified as SVT, 121 (41%) as DSVT and 25 (8%) as Afib. Atrial ATP efficacy was determined at several times post-therapy and found to improve significantly as a function of time, with 21% conversion at 10 secs (post therapy stored EGM) increasing to 41% at 40 secs (device defined efficacy), 47% at 1 min and 57.8% at 3 min. Efficacy was significantly dependent on rhythm type (33% effi- cacy for SVTs, 12% for DSVTs and 0% for Afib) and rate (overall efficacy for rhythms of < 200bpm was 69% versus 39% for >200bpm).

Conclusion: We conclude that atrial ATP has significant therapeutic potential for some types of AT. Additional analysis is required to determine any positive correlation between programming scheme and ATP efficacy.

Implantable Cardioverter Defibrillator Follow-Up: Will Office Visits Be Replaced by Transtelephonic Monitoring?

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Background: Outpatient implantable cardioverter defibrillator (ICD) follow-up (FU) is routinely performed every 3 to 4 months, at which time device interrogation and repro- gramming are possible. Transtelephonic monitoring (TTM) is currently available for of- fice visits.

Methods: We reviewed outpatient chart summaries of 78 patients (pts) with 587 office visits (median 7) to determine the frequency of interven- tions performed at FU. Reprogramming of tachycardia and bradycardia parameters, and changes in medical regimens based on ICD interrogations, were examined.

Results: Mean age was 65 ±12 yrs and ejection fraction did not have an impact on survival. Nine (90%) of the ten patients died. Age at implant, gender and the left ven- tricular ejection fraction did not have an impact on survival. Nine (90%) of the ten patients received appropriate ICD therapy. The mean duration to first ICD therapy was 10 ± 7 months after the implant. There were no inappropriate therapies.

Conclusion: Patients with cardiac sarcoidosis who have ICDs for secondary preven- tion of sudden death have a high rate of arrhythmia recurrence requiring ICD interven- tion. Poor NYHA functional class at the time of device implantation is associated with worse long-term survival.

Long-Term Outcome of Patients With Cardiac Sarcoidosis Receiving Implantable Cardioverter Defibrillators

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Background: Patients with cardiac sarcoidosis often develop malignant ventricular arrhythmias necessitating implantable cardioverter-defibrillator (ICD) therapy for secondary preven- tion of sudden death. The long term outcome and the predictors of survival in these patients are unknown.

Methods and Results: The study population included ten patients who were prospectiv- ely treated with cardiac sarcoidosis and received ICD for secondary prevention of sudden death. Baseline characteristics included demographics, implant indication, left ventricular ejection fraction, and NYHA functional class. Outcome measures included death, cardiac transplantation and time to first ICD therapy. The study group included six males and four female patients with a mean age of 42 ± 9 yrs. Fifty percent were Caucas- ian and the rest African American. Over a mean follow up of 48±14 months, four deaths occurred in the study population. The 1-, 2-, and 5-year survival was 100%, 67% and 44% respectively. NYHA functional class III and IV heart failure at the time of ICD implan- tation predicted poor long-term survival (p=0.01). Age at implant, gender and the left ven- tricular ejection fraction did not have an impact on survival. Nine (90%) of the ten patients received appropriate ICD therapy. The mean duration to first ICD therapy was 10 ± 7 months after the implant. There were no inappropriate therapies.

Conclusion: Patients with cardiac sarcoidosis who have ICDs for secondary preven- tion of sudden death have a high rate of arrhythmia recurrence requiring ICD interven- tion. Poor NYHA functional class at the time of device implantation is associated with worse long-term survival.