Optimisation of ICD therapy – DFT how to reduce it?

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The quick implantable cardioverter defibrillator trial (Quick-ICD) is an EPS and a DFT-testing still mandatory in patients with an indication for ICD-implantation?

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Background: Electrophysiological studies (EPS) and DFT-tests have been performed for various reasons before, during and after the implantation of ICDs. In some centres ICDs are implanted without extensive EPS or DFT-tests and the question has been raised, whether such tests are still necessary.

Study design. The Quick Implantable Defibrillator Study (Quick-ICD) was a prospective multi-centre trial which randomized patients after survived SCD to two different procedures: 1. the extensive procedure included an EPS before and a DFT-testing during ICD-implantation; 2. in the quick procedure the ICD was implanted without EPS or DFT tests and the ICDs were programmed according to a recommended standard. The primary endpoint was a cluster of adverse events related to the diagnostic procedures and the ICD-therapy including death, complications, clusters of shocks, inappropriate therapies, syncope, VTs below the detection rate and ineffective shocks. Secondary endpoints were clinical decisions and therapy costs. The hypothesis was that extensively tested patients fare better during follow-up.

Results: 196 patients were included in the trial, 100 randomized to the extensive procedure, 96 to a quick implantation. Mean FU was 12±7 months. 27 pts reached the endpoint in the quick group and 34 in the extensive group. Neither the event-free survival nor the number of ambulatory visits (10 vs. 10, n.s.) or the days in hospital for any reason (29 vs. 28, n.s.) during follow-up differed between the two study-populations. The quick implantation was not inferior to the extensive procedure in any respect. However, the initial hospital stay was significantly shorter in the quick implantation population (8.4±4.7 vs. 11.2±7.4, p=0.004).

Conclusion: The extensively tested patients did not fare better during follow-up, but the time of initial hospitalisation was significantly longer. It may therefore be feasible to dispense with an EPS and a DFT-testing in selected patients with an indication for ICD-implantation.

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Antitachycardia burst pacing in spontaneous ventricular tachycardias: how many pacing sequences should be programmed?

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Background and purpose: The efficacy and risk of several antitachycardia pacing (ATP) attempts has not been prospectively evaluated in patients (P) with implantable cardioverter defibrillators (ICD). A high success rate within a few sequences will avoid a long delay to ventricular tachycardia (VT) termination and reduce the number of shocks. This study was aimed at evaluating the efficacy and safety of the first, second and third attempt of ATP within the first ATP zone.

Methods: We studied 72 P (mean age 63 years, SD: 16; 63 male; previous myocardial infarction 71%), with clinical sustained monomorphic VT and a 3rd generation ICD. The efficacy and safety of 1, 2 or 3 attempts of a burst ATP-sequence in the first ATP zone were prospectively analysed. Burst ATP protocol consisted of 15 beats with a pacing cycle length (defined as percentage of VT cycle length) of 91%. A second ATP zone was programmed in a non-selected way in all P.

Results: During a mean follow-up of 32 months (SD: 19, range 3-68), 28 P received ATP therapy; they presented 1426 spontaneous arrhythmias (1315 considered V). The median number of spontaneous VT's per patient was 3 (interquartile range: 0-16). Mean VT cycle length was 335 ms (SD 43 ms, range: 286-408). The success rates of 1, 2 or 3 ATP attempts in the first ATP zone for spontaneous VT (success VT) were: 89%, 95% and 96% respectively (p<0.001, 2 or 3 versus 1 sequence; p=0.35, 3 versus 2 sequences). Acceleration rate was lower than 1%. Thirty eight percent of episodes unsuccessfully treated in the first ATP zone were terminated by ATP in the second ATP zone. Only 2% episodes required ICD shock for termination.

Conclusions: The first attempt with this ATP mode was highly efficient in terminating spontaneous VT with a very low acceleration risk. The addition of a second but not of a third additional ATP attempt in the same ATP zone can significantly improve this efficacy without increasing risk.

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ICD patients with elevated defibrillation threshold: clinical behavior and therapeutic alternatives

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Introduction: The ideal programming of ICD shock energy should be at least 10J above the defibrillation threshold (DFT), requiring alternative techniques when the DFT is high.

Aims: To assess the profile and clinical-functional behavior of ICD patients with DFT>25J and the efficacy of the chosen therapy.

Material and methods: A selection was made of patients which underwent to ICD implantation between Jan 00 and Aug 04 (prospective database) that presented intra-operative DFT>25J. The analyzed variables were: clinical-functional characteristics, LVEF (ECHO), rescue of arrhythmic events from ICD and causes of deaths.

Results: Among 476 patients, 163 (35.36%) presented DFT>25J. The mean age was 65.5±10.33 years, and 13 patients (8.1%) were men. Amiodarone was used by 94% of the patients. Mean follow up period was 25.3±4.7 months. The maximum programmable shock energy of the ICD ranged from 30 to 39J, DFT was higher than maximum energy shock in 2 patients (12.5%) and it was necessary to implant an additional shock electrode by thoracotomy (array). The procedures adopted and the clinical-functional characteristics according to the baseline cardiomyopathy are described in the table.

Cardiomyopathy n(%) LVEF PSFS Technique Evolution
Chagasic 9 (56%) 0.37 2 MEP in 7, Array in 2 3 NCD
Ischemic 4 (19%) 0.38 1 MEP in 4 2 NCD
Idiopathic 3 (25%) 0.38 0 MEP in 3 1 HFDC

NCD: non cardiac death, HFDC: heart failure death, MEP: maximum energy programmed, PSFS: patients with successful follow up shock, LVEF: left ventricular ejection fraction.

Conclusions: The prevalence of high DFT, in this cohort, was low. There was association with severe ventricular dysfunction, and no correlation with death. The alternative techniques were successful.

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Reduced defibrillation energy by vagal stimulation

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Background: previous work by Murakawa et al demonstrated a reduction in defibrillation energy of 35±12% (3.1J to 2.1J) for an epicardial patch shock vector in a canine. We explored whether these results would be
as significant for a conventional ICD shock vector and shock waveform studied in a closed chest preparation.

Methods: In 8 dogs, a Riata™ lead was implanted in the right ventricle and a "dummy ICD can" was implanted in the left pectoral region. A Cyberonics Model 300 cervical vagal stimulation lead was implanted on each of the left and right cervical vagi. Fibillation was induced with a 2s 9V potential between the RV Coil and Can. DFT was determined using a 4-step Bayesian estimator. Vagal stimulation was initiated 3 seconds after the onset of VF. Unilateral and bilateral vagal stimulation for different time durations relative to shock delivery were studied. In all cases, vagal stimulation was achieved by a 20Hz train of 4 ms pulses at 10mA. The shock waveform was a 5ms/5ms biphasic delivered between the RV Coil and Can via an HVS-02®.

Results: Vagal stimulation of all forms studied reduced the mean energy required to defibrillate. There was however wide inter-subject variability in the effect. Only the left cervical vagal stimulation delivered for 7 seconds before the shock and not continuing beyond the shock yielded statistically significant results. Here the result was a 38±15% reduction in defibrillation energy with all subjects showing a reduction in DFT. We observed no induced atrial arrhythmias during the course of our study.

Conclusions: The ability of unilateral left cervical vagal stimulation to significantly reduce the energy required for ventricular defibrillation.

329 Regional programming differences in the worldwide emPIRIC trial

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The emPIRIC trial tested the hypothesis that a standardized set of VT/VF detection and SVT discrimination parameters would be equivalent to physician tailored programming. The study enrolled 900 patients in the United States, Canada, United Kingdom, Austria, Saudi Arabia, and Kuwait. Patients were enrolled from August 2002 to October 2003.

Methods: Patients were randomized to standardized or physician tailored programming. This analysis focuses on the 455 patients randomized to the physician tailored arm because there were no restrictions on how they were programmed. Measures used to determine differences include ATP use at rates faster than 2000pm, use of aggressive SVT algorithms in discriminating 1:1 rhythms (1:1 ST-VT Boundary of 66% or greater), and the number of intervals to detect an arrhythmia in the VF zone (VF NID 18/24 beats or greater). The treated-cutoff is defined as the slowest rate at which an episode will be detected. Treated-cutoff was analyzed based on a history of spontaneous sustained monomorphic VT (MVT).

Results: Secondary prevention patients accounted for 49% of the implants in the United States, 69% of the implants in Canada, and 85% of the implants outside of North America. Table 1 lists the key metrics by region and tests for significant changes using the Fisher Exact and Kruskal-Wallis tests.

Table 1

<table>
<thead>
<tr>
<th>Region</th>
<th>N patients</th>
<th>Total VT/VF events</th>
<th>Events treated with ATP</th>
<th>ATP Efficacy</th>
<th>Total Shocked VT/VF Episodes</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empiric</td>
<td>445</td>
<td>649</td>
<td>509</td>
<td>92.3%</td>
<td>110 (39)</td>
<td></td>
</tr>
<tr>
<td>Tailored</td>
<td>455</td>
<td>714</td>
<td>540</td>
<td>88.9%</td>
<td>169 (49)</td>
<td></td>
</tr>
<tr>
<td>All Patients</td>
<td>900</td>
<td>1363</td>
<td>1049</td>
<td>90.6%</td>
<td>279 (88)</td>
<td></td>
</tr>
</tbody>
</table>

Conclusions: Regional programming differences were observed across the three regions. ATP use for faster rhythms was more prevalent outside of North America, whereas aggressive SVT discriminator use was more prevalent in the United States. The United States physicians treated fast rhythms sooner than the physicians in Canada or outside of North America.

330 Standardized extensive ATP programming reduces shocks for VT/VF compared to usual physician programming: results from the emPIRIC trial


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Anti-Tachycardia Pacing (ATP) has been proven to be effective at terminating monomorphic ventricular tachycardia (MVVT) without the need for painful shock therapies. While ATP is frequently used in patients with known MVT and for slower VTs, many physicians do not use it for other patients or for faster VTs. Broader application of ATP through a standardized programming approach would give the benefit of ATP to more ventricular arrhythmias, possibly decreasing the need for shock termination. The objective of this analysis is to compare ATP efficacy and shocks delivered for true VT/VF between patients with standardized programming and those with physician-tailored programming.

Methods: The emPIRIC trial enrolled 900 patients from 54 centers in 6 countries. ICDs were implanted for a mixture of primary (46%) and secondary (54%) prevention indications. Of the 900 patients, 445 were assigned to standardized VT/VF detection and therapies, which included 1 ATP attempt for MVT occurring at 240 to 290 ms and 3 ATP attempts for MVT ≥300 ms. The other 455 patients were programmed according to their attending electrophysiologist’s discretion (Tailored arm). The average patient follow-up was 11 ± 3 months. All stored EGMs were adjudicated by at least two reviewers.

Results: There were 99 patients in the Empiric arm and 100 patients in the Tailored arm with at least 1 true VT/VF event. The percent of patients with ATP on for ventricular rhythms <320 ms was 65% in the Tailored arm and 99% in the Empiric arm. Standardized programming reduces shocks for VT/VF compared to usual physician programming: results from the emPIRIC trial.