EDITORIAL COMMENTARY

One size fits all, or do we have to rethink optimal programming in implantable cardioverter-defibrillators implanted for secondary prevention?

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There is no doubt that the implantable cardioverter-defibrillator (ICD) has revolutionized the treatment of patients at risk for sudden cardiac death due to ventricular tachyarrhythmias. Over the last almost 4 decades, remarkable technological advances have made ICDs easier and safer to implant and widely accepted by patients and physicians. The delivery of ICD therapy for treatment of life-threatening arrhythmias is highly effective; however, the challenges of preventing unnecessary shocks remain to this day. In addition to anxiety, depression, posttraumatic stress disorder, and phantom shock, both inappropriate and appropriate shocks are associated with increased mortality.[1–3] ICD shocks have been shown to cause myocardial injury and are potentially proarrhythmic.[4] In both secondary prevention (AVID [Antiarrhythmics Versus Implantable Defibrillators][5]) and primary prevention (SCD-HeFT [Sudden Cardiac Death in Heart Failure Trial],[6] MADIT II [Multicenter Automatic Defibrillator Implantation Trial II][7]) studies, the receipt of ICD therapies was associated with a 3- to 5-fold higher risk of death that was temporally related to the receipt of these ICD therapies.

Contemporary device programming, including delayed detection and use of discriminator functions, is associated with lower risks of inappropriate shocks.[3] However, the group of patients who are receiving ICD for secondary prevention still poses a challenge. In these patients, ventricular tachycardia (VT) episodes have longer cycle lengths compared with cycle lengths of VT in patients receiving an ICD for primary prevention.[8]

This results in greater overlap of cycle lengths between supraventricular tachycardia and VT and make appropriate programming a challenge. In addition, patients who have received an ICD for secondary prevention have 3-fold higher rates of recurrent ventricular arrhythmias triggering appropriate ICD intervention than recipients of primary prevention ICDs.[9] Ideally, successful programming should reconcile this difficulty and result in appropriate treatment of ventricular arrhythmias while avoiding shocks for supraventricular arrhythmias.

Unfortunately, published data on optimal ICD programming for secondary prevention patients are limited. In the EMPIRIC (Comparison of Empiric to Physician-Tailored Programming of Implantable Cardioverter-Defibrillators) study, 53% of patients (n = 480) received a defibrillator for secondary prevention and were randomized to a physician-tailored or an empiric approach with the goal of reducing unnecessary shocks. Although the study did demonstrate that antitachycardia pacing (ATP) was highly effective and that few adverse events were related to untreated slow VT, the therapy reduction programming was not aggressive, and it does not match contemporary programming.[10] In the ADVANCE III (Avoid DeliVering TherApies for Non-sustained Arrhythmias in ICD PatiEnts III) study, 25% of the patients received an ICD for secondary prevention, but this study limited its results to the benefit of increasing the number of intervals needed to detect the arrhythmia to 30 of 40 beats in a zone of relatively slower ventricular arrhythmia (<188 bpm).[11] The 1500-patient MADIT-RIT (Multicenter Automatic Defibrillator Implantation Trial–Reduce Inappropriate Therapy) study did not enroll patients with secondary prevention ICD but demonstrated a significantly lower delivery of inappropriate therapy as well as a reduction in mortality by using either high-rate cutoff for detection (200 bpm) or delayed detection duration with ATP/shocks varied by rate.[12]

In this issue of *Heart Rhythm O*^{2}, Aktas et al[13] add to the missing gap in our knowledge on how to appropriately program the ICD in patients who initially received the device for primary prevention but then experienced VT by performing a subanalysis of the MADIT-RIT trial. Strictly speaking, the patients studied cannot be classified as patients receiving an ICD for secondary prevention. In addition, in this group of patients one would expect the initial episodes of ventricular arrhythmias to have faster heart rates than in patients who received an ICD for secondary prevention. At the discretion

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https://doi.org/10.1016/j.hroo.2020.05.001

of their treating physician, patients were either maintained in their originally assigned treatment arm or reassigned to Arm A (conventional: VT ≥170 bpm), Arm B (high rate: VT ≥200 bpm), or Arm C (duration delay: >60-second delay before therapy ≥170 bpm). Among 205 patients who experienced a first occurrence of VT, at 15-month follow up, multivariate analysis showed that patients programmed to Arm B/C had a 71% ($P = .02$) reduction in the risk of inappropriate ICD therapies and a 43% ($P = .02$) reduction in risk of appropriate ICD therapies compared to Arm A. No firm conclusion can be drawn about an associated reduction in either mortality or cardiovascular events given the small number of patients.

However, these results are encouraging. Reduction of inappropriate therapies has already been shown with this approach.[12] We also know that most episodes of sustained VT will terminate spontaneously.[14] It does seem that assigning patients to Arm B/C results in less appropriate ATP and shock incidence because of this phenomenon. Interestingly, programming changes were made in only 15% of the patients (n = 30) after they experienced a VT episode. The small number of patients in whom programming changes were made and the nonrandomized nature of the study prevent us from drawing strong conclusions. Only 5 of these 30 patients were changed to a different group, with 4 migrating to Arm A from Arm B/C and only 1 patient transferring to Arm B/C from Arm A. In the end, 57% of the patients were programmed to Arm A settings and 43% to Arm B/C settings. Without the granular patient detail, we are not sure what prompted the programming changes, whether underdetection was due to slower VT rates, or whether hemodynamic instability occurred. Also unclear is why most of the patients were left in Arm A, but it is assumed that the detection/therapy delivered was believed to be appropriate.

Either way, it does seem that the patients programmed to Arm B/C derived benefit irrespective of cycle length and hemodynamic status. This is another strong signal that shows lack of adverse effects and safety when programming the ICD with delayed or high-rate detection. Although patients programmed to high-rate cutoff (Arm B) and delayed detection (Arm C) were considered together in this substudy, when considered separately both groups demonstrated a reduction in appropriate and inappropriate ICD therapies. Should we then blindly program to Arm B/C detection criteria our patients who have received ICD for secondary prevention? Recent guidelines recommend programming the ICD in patients with known ventricular arrhythmia to a rate detection 10–20 beats below the tachycardia rate.[15] We agree, one should be more specific and pay attention to the clinical characteristics of the tachycardia, program the ICD to mitigate potential hemodynamic detriment, and of course consider what this article adds to our knowledge that long detection intervals and/or a high-rate cutoff are safe in these patients.

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