Provocative Case: Defibrillation Threshold Testing at Generator Change – Not So SIMPLE

Adam Lee
Zian Tseng

Introduction: Omission of defibrillation threshold (DFT) testing and programming of prolonged detection intervals is common in contemporary management of implantable cardioverter-defibrillators (ICDs).

Methods: We present a case scenario in which DFT testing and short detection intervals are warranted. The utility of testing an alternative manufacturer’s generator in the event of inadequate VF sensing is demonstrated.

Result: A 52 year old female presented for generator replacement of a dual chamber ICD, implanted for secondary prevention of idiopathic VF. The system consisted of a Boston Scientific Teligen 100 (E110) generator, Fineline II Sterox EZ (4470) RA lead and Endotak Reliance G (0185) integrated bipolar RV/ICD lead. Parameters at recent interrogation were stable (sensing/threshold/impedance: 5.2 mV, 1.2V @ 0.4 ms, 403 Ω [RA], 7.1 mV, 1.6V @ 0.4 ms, 459 Ω [RV]). However, the measured R-waves during intra-operative testing were only 3.5 – 5.5 mV. Accordingly, following generator replacement (Boston Scientific Dynagen), VF induction was performed to confirm adequacy of VF sensing. VF induction was performed at least sensitivity (1.5 mV) with nominal detection (1 s) in the VF zone. Gross undersensing was evident with complete failure to detect VF necessitating a rescue shock to restore sinus rhythm (Panel A). VF induction was repeated at a higher sensitivity (1.0 mV). There was significant initial undersensing, though VF was ultimately detected. However, there was immediate charge diversion due to undersensing followed by VF redetection, a committed but unsuccessful shock (at 21 J), then gross VF undersensing, necessitating another external rescue shock (Panel B). As the nominal sensitivity was 0.6 mV, an adequate safety margin of VF sensing had not been demonstrated. Lead extraction was not an acute option and lead revision with abandonment of the prior lead was not appropriate given her age. A alternative manufacturer’s generator was tested. VF induction was repeated with a Medtronic Evera XT at least sensitivity (1.2 mV) with prolonged detection (30/40 intervals) in the VF zone. Despite initial undersensing, VF was detected with successful defibrillation (15.1J) to SR (Panel C). VF induction was retested at nominal sensitivity (0.3 mV) with prolonged detection demonstrating appropriate VF sensing and DFTs (Panel D). The Medtronic generator was programmed with a single VF zone from 188 bpm with shortened detection intervals (18/24) to allow for potential VF undersensing. The patient will undergo elective RV/ICD lead extraction and re-implantation.

Conclusion: The presence of poor R-wave sensing in SR (≤ 5–7 mV), should prompt VF induction testing. In the event of VF undersensing, an alternative manufacturer’s generator may be a reasonable bridging solution if an adequate safety margin is achievable. Prolonged interval detection should not be programmed in patients with unreliable VF sensing.