

## LETTER TO THE EDITOR

## Defibrillation failure: Considerations

We have read with great interest the case report entitled "Subcutaneous ICD implantation in a patient with hypertrophic cardiomyopathy after transvenous ICD failure: A case report" by Baroni et al<sup>1</sup> in the journal. They presented a case with hypertrophic cardiomyopathy and reduced ejection fraction underwent left-sided transvenous implantable cardioverter-defibrillator (ICD) revision due to previous right-sided ICD lead failure. However, revised new ICD system failed to pass the defibrillation tests with various energy levels and shock configurations. Finally, an implanted subcutaneous ICD achieved the defibrillation test. Various etiologies causing failed defibrillation test are present that some of which have been discussed by the authors. The analysis of the Sudden Cardiac Death in Heart Failure (SCD-HeFT) Trial results has demonstrated that overall mortality, sudden cardiac death, appropriate shock rate, first shock efficacy, and the mean defibrillation threshold were not different between dual- and single-coil leads.<sup>2</sup> However, in some cases with elevated defibrillation threshold, implantation of a dual-coil shock lead can effectively convert the induced arrhythmia using changes in shock vector, resistance, and phase duration. On the other hand, as younger patients with longer life expectancies are more susceptible to device hardware failure and infection, a necessary extraction procedure can be challenging due to a superior vena cava coil.<sup>3</sup> Vector changing in a posterior direction using a superior vena cava coil, located in the thoracic veins not in the right atrium, can result in effective defibrillation. An important noninvasive issue regarding shock waveform and related to coil number is the tilt value of the device. With a fixed tilt value, higher lead impedances result in higher duration of pulse of the first phase of the biphasic waveform. Conversely, with a fixed pulse duration value, higher lead impedances cause reduced tilt values. A single-coil lead with a higher impedance level compared to a dual-coil lead with a lower impedance can achieve effective defibrillation at a 50% tilt value. On the other hand, a fixed tilt value of 60% or more can need a lower impedance that can be achieved with the addition of a coil. Some manufacturers' devices have programmable tilt and phase duration values, and some have nonprogrammable fixed values. With the use of a single-coil lead, a tilt level of 50% seems as the most appropriate to achieve successful defibrillation. All factors affecting the defibrillation threshold and the management of patients with high defibrillation threshold are not within the scope of this letter. Finally, although the prognosis of such patients with hypertrophy and low ejection fraction is worse, especially in young patients having longer life

expectancies, the high rate of lifetime magnetic resonance imaging (MRI) requirement should not be missed. Therefore, complete removal of the abandoned lead and implantation of an MRI conditional device, either transvenous or subcutaneous, can be the most appropriate approach in the management of such patients although recent data have showed that, even in the case of an abandoned lead and nonconditional device, MRI can be safely performed with necessary precautions.<sup>4,5</sup>

## CONFLICT OF INTEREST

Authors declare no conflict of interests for this article.

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## REFERENCES

1. Baroni M, Cattafi G, Arupi M, Paolucci M, Pelenghi S, Lunati M. Subcutaneous ICD implantation in a patient with hypertrophic cardiomyopathy after transvenous ICD failure: A case report. *J Arrhythmia*. 2017;34:1–3.
2. Aoukar PS, Poole JE, Johnson GW, et al. No benefit of a dual coil over a single coil ICD lead: evidence from the Sudden Cardiac Death in Heart Failure Trial. *Heart Rhythm*. 2013;10:970–6.
3. Almealmadi F, Manlucu J. Should single-coil implantable cardioverter defibrillator leads be used in all patients? *Card Electrophysiol Clin*. 2018;10:59–66.

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4. Russo RJ, Costa HS, Silva PD, et al. Assessing the risks associated with MRI in patients with a pacemaker or defibrillator. *N Engl J Med*. 2017;376:755–64.
5. Padmanabhan D, Kella DK, Mehta R, et al. Safety of magnetic resonance imaging in patients with legacy pacemakers and defibrillators and abandoned leads. *Heart Rhythm*. 2018;15:228–33.