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Customizing solutions: Ventricular tachycardia and implantable cardioverter-defibrillator programming

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Personalização de soluções: taquicardia ventricular e programação de CDI

A 73-year-old male underwent implantable cardioverter-defibrillator (ICD) interrogation in our outpatient clinic following an administered shock. His medical history included heart failure due to non-ischemic dilated cardiomyopathy with reduced ejection fraction (24%), chronic atrial fibrillation (AF), severe mitral regurgitation (Mitraclip intervention in 2016) and implantation of an ICD for primary prevention (2016).

Six months before the current observation, an inappropriate ICD shock due to AF with a rapid ventricular response during a febrile episode prompted an escalation in beta-blocker therapy.

Interrogation of the device (Abbott Ellipse VR system) disclosed VVI mode with a lower pacing rate of 40 bpm and 29% ventricular pacing. A single episode of ventricular arrhythmia within the ventricular fibrillation (VF) zone was identified, programmed with a cutoff from 214 bpm.

Analysis of the episode unveiled an arrhythmic sequence initiated by a premature ventricular contraction (PVC), succeeded by a pause and subsequent ventricular stimulation at the baseline rate of 40 bpm. Another PVC ensued, leading to a polymorphic ventricular tachycardia within the VF detection zone (Figure 1). A 30-J ICD shock successfully terminated the consequent tachydysrhythmia event. Notably, anti-tachycardia pacing (ATP) during charging was precluded due to the elevated ventricular rate exceeding the ATP application threshold (upper limit cutoff set at 250 bpm) (Figure 2).

The observed presence of PVCs and a low baseline stimulation rate engendered a ‘short-long-short’ pattern – a characteristic feature associated with the induction of polymorphic ventricular tachycardia.

In view of this occurrence, the patient’s device settings were adjusted to institute pacing with a higher baseline ventricular rate (60 bpm), a strategic measure to mitigate the likelihood of future ventricular tachyarrhythmia events. During a six-month follow-up, sustained ventricular arrhythmias were no longer observed.

Key messages

A standard guideline-recommended programming of a single-chamber ICD with a low basic rate (40 bpm) could be proarrhythmic in some groups of patients.[1-3] In this type of clinical case, a customized adjustment strategy should be applied to diminish the risk of ICD-induced ventricular arrhythmias.

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No

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Conflicts of interest

The authors have no conflicts of interest to declare.

References

1. Glikson M, Nielsen JC, Kronborg MB, et al., ESC Scientific Document Group. 2021 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy. Eur Heart J. 2021 Sep 14;42(35):3427-3520. doi: 10.1093/eurheartj/ehab364. Erratum in: Eur Heart J. 2022 May 1;43(17):1651. PMID: 34455430.
2. Stiles MK, Fauchier L, Morillo CA, Wilkoff BL; ESC Scientific Document Group. 2019 HRS/EHRA/APHRS/LAHRS focused update to 2015 expert consensus statement on optimal

implantable cardioverter-defibrillator programming and testing. Europace. 2019 Sep 1;21(9):1442-1443. doi: 10.1093/europace/euz065. PMID: 31090914..

3. Sweeney MO, Ruetz LL, Belk P, Mullen TJ, Johnson JW, Sheldon T. Bradycardia pacing-induced short-long-short sequences at the onset of ventricular tachyarrhythmias: a possible mechanism of proarrhythmia? J Am Coll Cardiol. 2007 Aug 14;50(7):614-22. doi: 10.1016/j.jacc.2007.02.077. Epub 2007 Jul 30. PMID: 17692746.

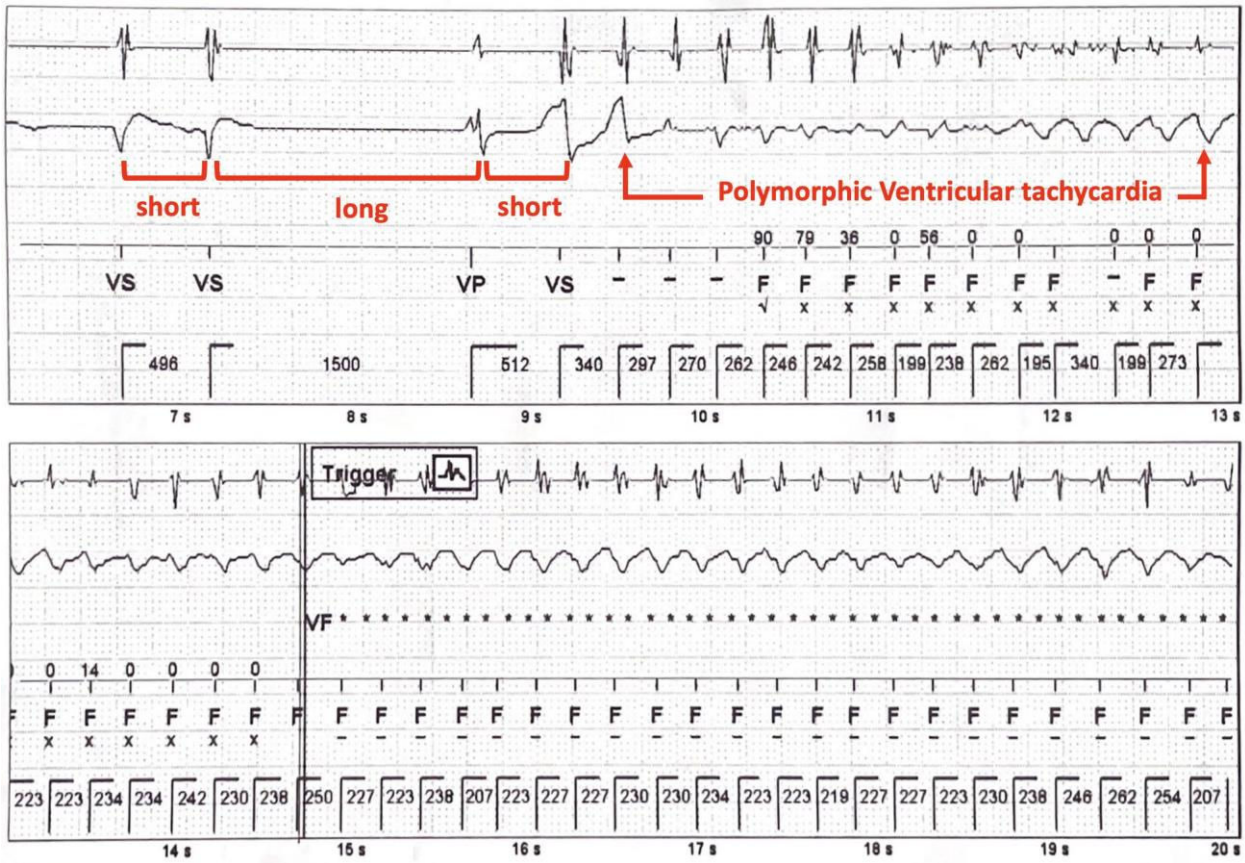

Figure 1 Premature ventricular contractions and low pacing rate creating a 'short-long-short' pattern and inducing polymorphic ventricular tachycardia.

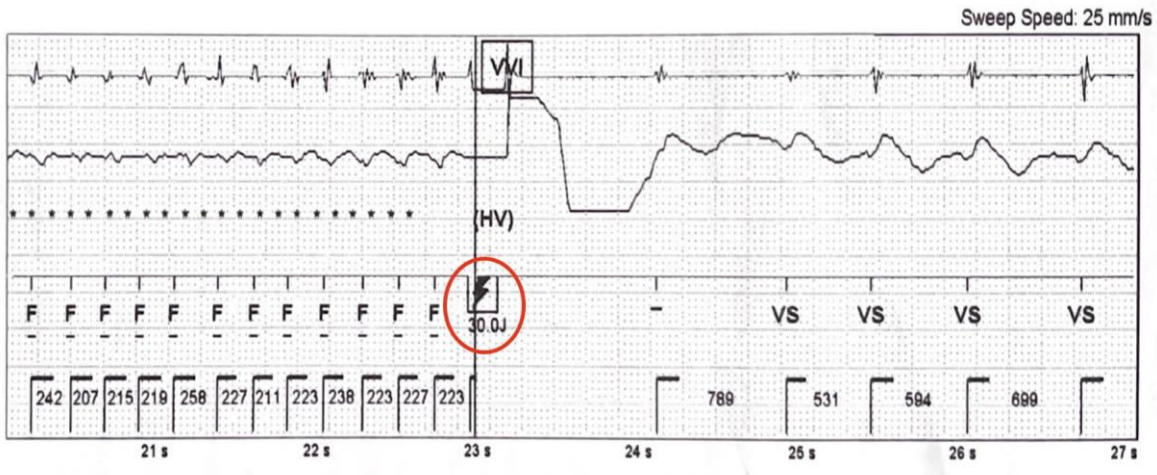

Figure 2 Successful termination of ventricular tachycardia by a 30-J implantable cardioverter-defibrillator shock.