Post-shock oversensing by a subcutaneous defibrillator resulting in inappropriate withholding of post-shock bradycardia pacing

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The total subcutaneous implantable cardioverter defibrillator (S-ICD) is an alternative to transvenous devices. We describe a patient with hypertrophic cardiomyopathy with an S-ICD who experienced an episode of ventricular fibrillation that was adequately sensed and terminated by a high voltage shock. Post-shock there was asystole with oversensing by the device leading to inadequate withholding of post-shock pacing.

Implantable cardioverter defibrillators (ICDs) can effectively treat episodes of ventricular arrhythmias in patients at risk for these potentially life-threatening events. Because of frequent occurrence of ICD-related complications that are often related to transvenous and

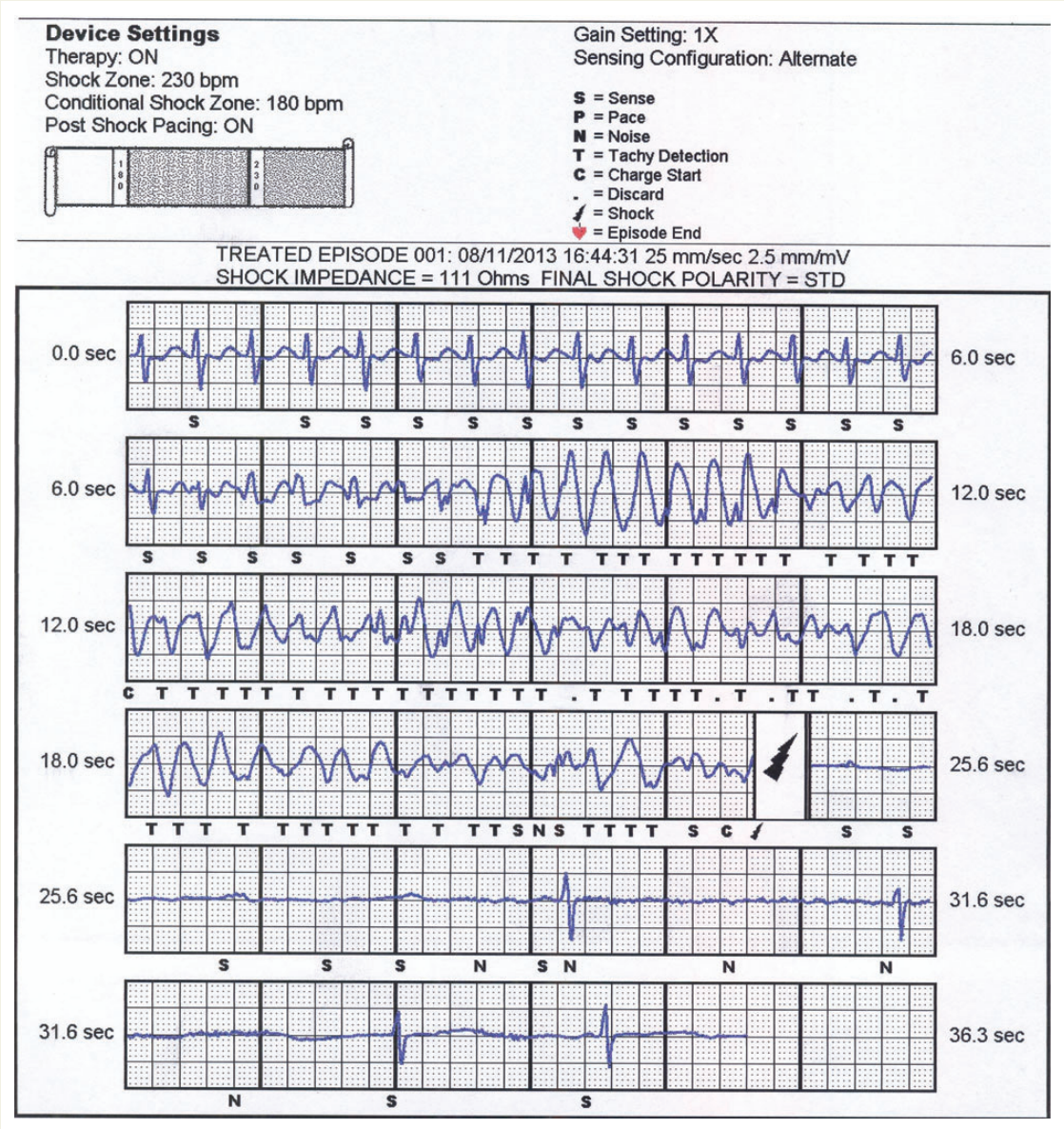

Figure 1 Episode from an S-ICD demonstrating sinustachycardia followed by VF adequately treated with defibrillation. Post-shock an asystole of >4 s was not treated by post-shock pacing because of oversensing.

intracardiac placement of electrodes, a total subcutaneous ICD (S-ICD) has been developed.[1] This device can effectively deliver shock therapy for ventricular tachyarrhythmias but is unable to treat primary bradyarrhythmias. For potentially slow recovery of sinus rhythm after shock therapy, brief post-shock pacing is possible with an S-ICD.

A 30-year-old woman with hypertrophic cardiomyopathy had received an S-ICD 2 years before presentation after out-of-hospital cardiac arrest with ventricular fibrillation (VF) for secondary prevention of sudden cardiac death. Follow-up had been uneventful until presentation to the emergency room after transient loss of consciousness at a train station where she had to run in order to not miss her train. She had no recollection of the event. No cardiac massage was performed and no seizure-like muscle contractions were reported by bystanders.

Check-up of the S-ICD revealed an episode of sinus tachycardia followed by VF that was adequately detected by the device and terminated after 15 s with a high-voltage shock of 80 J (*Figure 1*). Ventricular fibrillation was terminated but sinus rhythm did not resume immediately. After an asystole of >4 s, the patient developed slow, most likely supraventricular or nodal, escape rhythm. Post-shock pacing had been programmed on but was inadequately withheld because of oversensing of unknown origin (S). The escape rhythm was labelled as noise (N) until after 9 s escape beats were adequately labelled (S).

This case illustrates adequate sensing and termination of VF by an S-ICD followed by oversensing and inadequate withholding of post-shock pacing. The oversensing is most likely due to very sensitive automated settings post-shock to prevent lack of redetection of VF in case of unsuccessful shock therapy. In contrast to conventional ICDs, sensing is not programmable to a certain number of fast intervals and the same is true for redetection intervals. Due to this lack of programming capability, no changes were made to the system for future events. We considered a using a different vector for sensing but avoided this programming change as VF was adequately detected and we did not want to risk undersensing of VF in order to adequately sense cardiac activity post-shock. It is unlikely that this device malfunction contributed to loss of consciousness since the patient has no recollection of the shock suggesting VF already leading to loss of adequate cerebral perfusion. This device malfunction can, however, have detrimental effects after an episode of ventricular tachycardia where loss of consciousness could actually be precipitated by prolonged aystole. Furthermore, bradycardia could potentially precipitate reinitiation of ventricular arrhythmias.

To our knowledge, oversensing after successful termination of VF by an S-ICD has not been described before. Recent years have seen numerous case reports on S-ICDs and description of medium-term follow-up.[2] Future device upgrades could possibly solve this problem but adequate detection of unsuccessful shock therapy needs to be assured as well.

Conflict of interest: A.H.M. has received lecture fees from Medtronic, Biotronik, Boston Scientific, and Sorin.

References

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