



Induced atrial fibrillation during defibrillation test on implantation of subcutaneous implantable cardioverter defibrillator

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The subcutaneous implantable cardioverter defibrillator (S-ICD) has become an alternative to the transvenous ICD in indicated patients. However, inappropriate shock or failed ventricular tachycardia/fibrillation conversion is the most alarming complication of S-ICD. Therefore, defibrillation test (DFT) is recommended for the S-ICD implantation. However, the DFT can provoke or worsen cardiac arrhythmias. We present two induced atrial fibrillation (AF) cases by DC bursts on DFT during S-ICD implantation. The AF was not terminated by the 65-J S-ICD shock, even when ventricular fibrillation was terminated.

Case 1. A 49-year-old female patient was transferred to our emergency room with sudden collapse due to the ventricular fibrillation (VF). After DC cardioversion by the emergency medical team on the spot, her rhythm was recovered. There was no reversible cause for her VF, and implantation of the S-ICD was planned. The device was an EMBLEM™ MRI S-ICD (Boston Scientific, Marlborough, MA, United States). The ICD implantation was performed under conscious sedation with local anesthesia. Two incisions were made at the midaxillary and subxiphoid areas respectively, and the pulse generator was placed into the intermuscular space on the left midaxillary line between ribs five and six. The subcutaneous lead was placed parallel to the left of the sternum, targeting near the sternal notch.^[1,2] Standardized DFT was performed by delivery via the programmer. The first shock energy was set to 65-J, the second shock energy was set to 80-J, followed by an external rescue shock to 360-J if ineffective. The sensing vector (primary, secondary, or alternate) was automatically selected by the device and 50-Hz, 200-mA DC bursts for four to six seconds were used for the induction of VF. The first induced VF was spontaneously terminated; however, the AF was induced and persisted after the DC bursts (Figure 1). The

second VF induction showed the same pattern of non-sustained VF and the AF was still ongoing, which was spontaneously terminated in two minutes. The third instance of DC bursts for four seconds finally induced sustained VF, which was successfully terminated by 65-J of the S-ICD shock. However, the AF was again induced and sustained after the shock and spontaneously terminated ten minutes later (Figure 2). The implantation procedures were completed without further complications. After recovering the sinus rhythm, the AF was no longer observed until the discharge of the patient.

Case 2. A 46-year-old woman was delivered to our emergency room with sudden collapse due to the VF. Before her collapse, she had consumed two bottles of alcohol. After DC cardioversion by the emergency medical team on the spot, her rhythm was recovered. She had no history of any illness or medication. Her initial electrocardiogram after DC version was normal sinus rhythm. Echocardiography showed normal heart function and ergonovine provocation coronary angiogram showed negative findings. Consequently, the implantation of S-ICD was planned. The S-ICD was the same product and the implantation procedure was identical to that in Case 1. Standardized DFT was performed and the shock setting and induction method were the same as those in Case 1. The sensing vector was automatically selected by the device and 50-Hz, 200-mA DC bursts for four seconds were used for the induction of VF. However, the AF was induced instead of VF (Figure 3). Notably, the AF was terminated spontaneously within a short period of time. Subsequently, the VF induction was successful and the VF was successfully terminated by the first 65-J of the S-ICD shock. The implantation procedures were completed without further complications and the AF was not observed after DFT.

The S-ICD has become an alternative to the transvenous ICD in indicated patients.^[3] However, the S-ICD can also

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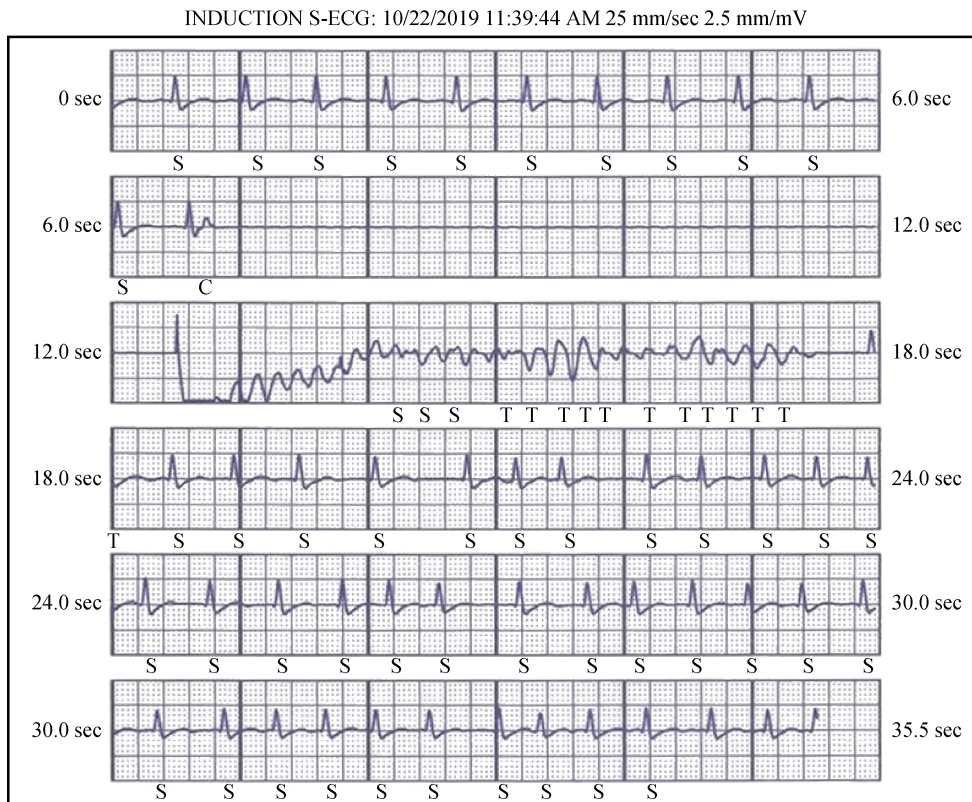


Figure 1. Non-sustained VF was induced by 50-Hz DC bursts. After the spontaneous termination of the VF, the atrial fibrillation was induced and persisted. VF: ventricular fibrillation.

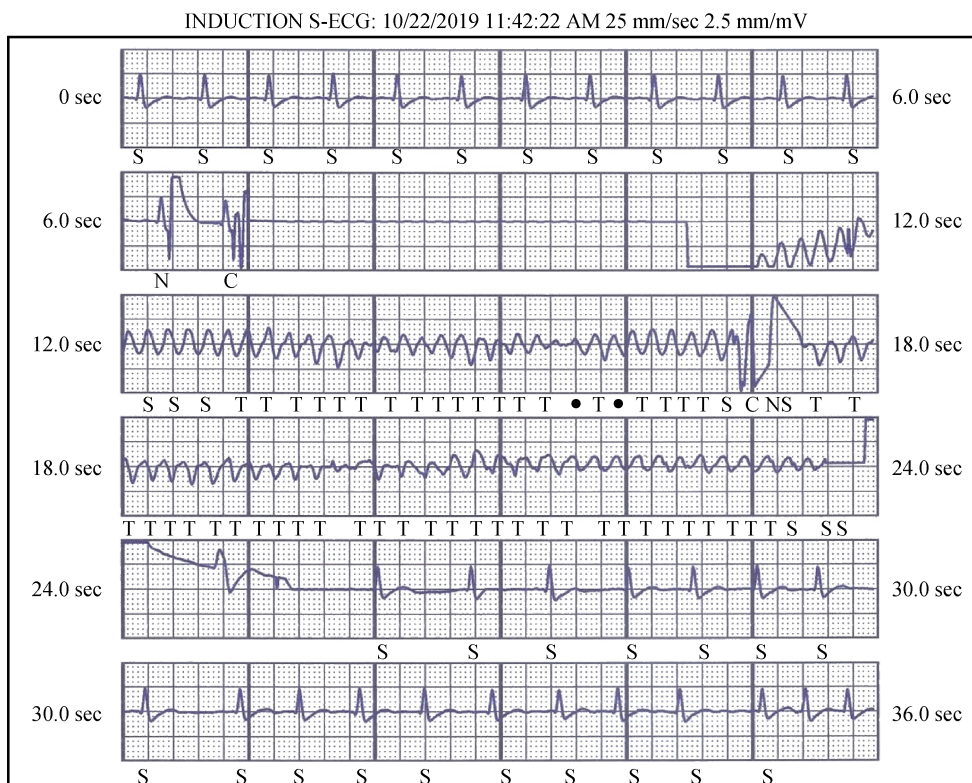


Figure 2. DC bursts for four seconds induced sustained ventricular fibrillation, which was successfully terminated by 65-J of the S-ICD shock. However, atrial fibrillation was induced and sustained after the shock.

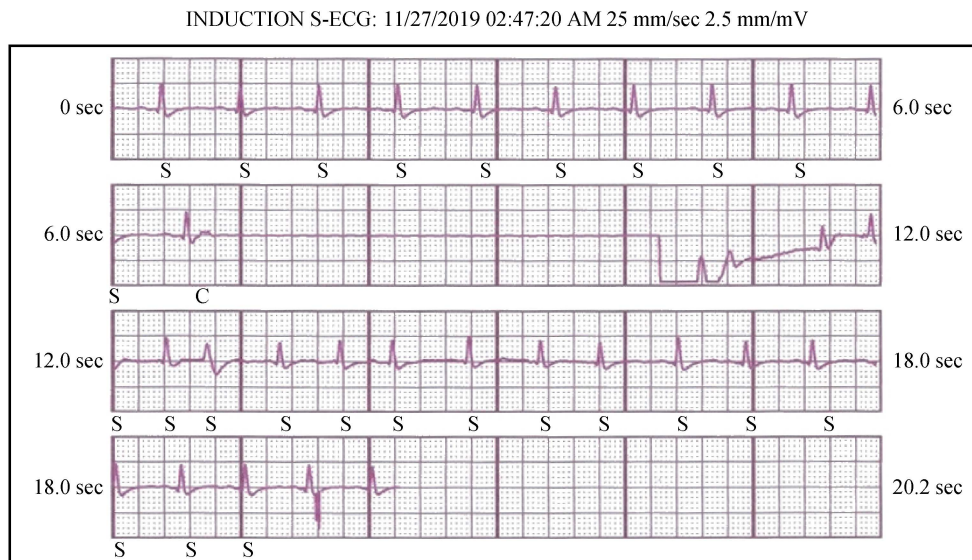


Figure 3. DC bursts for four seconds were attempted for the induction of VF. However, the atrial fibrillation was induced instead of VF. VF: ventricular fibrillation.

cause several complications. Among them, inappropriate shock due to oversensing or failed ventricular tachycardia/fibrillation conversion is the most critical complication of S-ICD. As the subcutaneously positioned electrodes are widely spaced and are placed at greater distances from the ventricle, a higher amount of energy is required for the successful termination of arrhythmias.^[1,3] Therefore, the DFT is recommended as a class I indication for assessing arrhythmia detection and termination for the S-ICD implantation.^[3-6] However, the DFT itself or cardioversion shock has the capacity to provoke or worsen cardiac arrhythmias.^[7] The majority of the reported episodes are transient; however, they may be sustained in patients with the substrate to support AF or atrial flutter and induced AF with a rapid ventricular response may cause several serious situations.^[7] In addition, supraventricular tachycardias (SVT) are complicated in 6% of external cardioversions for ventricular tachyarrhythmia.^[8] Judging from these results, SVT, especially the AF could be complicated by the DFT during the S-ICD implantation. To the best of our knowledge, there is no report of induced AF during the DFT on S-ICD implantation. In our center, two cases of induced AF were observed by DC bursts on S-ICD implantation. The AF in Case 1 was not terminated by the 65-J S-ICD shock, even when the VF was terminated. Further research and case reports about induced AF or SVT burden, adequate management, and prognosis during the DFT on S-ICD implantation will be required.

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