Fractured Lead Case Study

By James Strickland, MD
Heart Rhythm Associates

FRACTURED LEAD CASE STUDY

By James Strickland, MD, Heart Rhythm Associates

History of Present Illness (HPI)

A 67 year old male with a prior history of myocardial infarction, ischemic cardiomyopathy, and coronary artery bypass graft surgery, underwent a Biventricular ICD (BI-V ICD) generator change out procedure due to the battery reaching the elective replacement indicator (ERI). The patient's right ventricular (RV) lead was known to be under recall but was functioning within normal limits.

During the change out procedure, the original device was removed. Attempts were made to remove and replace the RV lead due to the recall. The attempts were unsuccessful due to scar tissue at the site of the superior vena cava coil. The left ventricular (LV) lead was tested and demonstrated a high pacing threshold. The LV lead was successfully repositioned to improve pacing thresholds. All leads were tested again and were found to be within normal limits (Table1). No diaphragmatic stimulation was observed at maximum output.

Table 1: Testing thresholds at generator change out

	Atrium	RV	LV
Sensing	5.2	30.0	5.2
Impedance	528	629	248
Threshold	.6	.5	1.2
Pulse Width	.5	.5	.5
Current	1.1	.6	5.5
Slew Rate	1.7	4.0	3.8

The pocket was repeatedly irrigated with an antibiotic solution and the original leads were secured to a new device. No defibrillation threshold testing was performed and the patient was transported to a recovery unit where the device was programmed. The patient tolerated the procedure with no complications.

One month later, the patient was shocked twice by his BI-V ICD twice while at home. The patient was instructed by his physician to go to the emergency room where the device was interrogated. The device interrogation determined that noise from a malfunctioning lead (lead fracture) was the cause of the two shocks.

Impressions/Plan

Due to the prior unsuccessful attempts to extract the RV lead, Electrophysiology made a determination that it would be necessary to remove the RV lead by a lead extraction procedure. This procedure was not available at the admitting hospital. The device was programmed to continue to BI-V pace to provide cardiac resynchronization therapy, but the defibrillation therapy was programmed off to prevent further unnecessary shocks to the patient. The patient was discharged to home wearing a wearable cardioverter defibrillator (WCD), (manufactured by ZOLL, Pittsburgh, PA, marketed under the brand name LifeVest®). The patient was scheduled to follow-up with his Electrophysiologist to schedule the lead extraction procedure.

Clinical Update

Two weeks prior to the scheduled lead extraction/replacement procedure, the patient experienced an episode of ventricular flutter which progressed to ventricular fibrillation (VF) (Figure 1).
The patient's WCD appropriately detected the episode, and delivered a 150J biphasic treatment shock 48 seconds later (Figure 2). The treatment successfully converted his VF to a normal sinus rhythm at a rate of 61 BPM. The patient was instructed to continue to wear the WCD until his scheduled lead extraction.

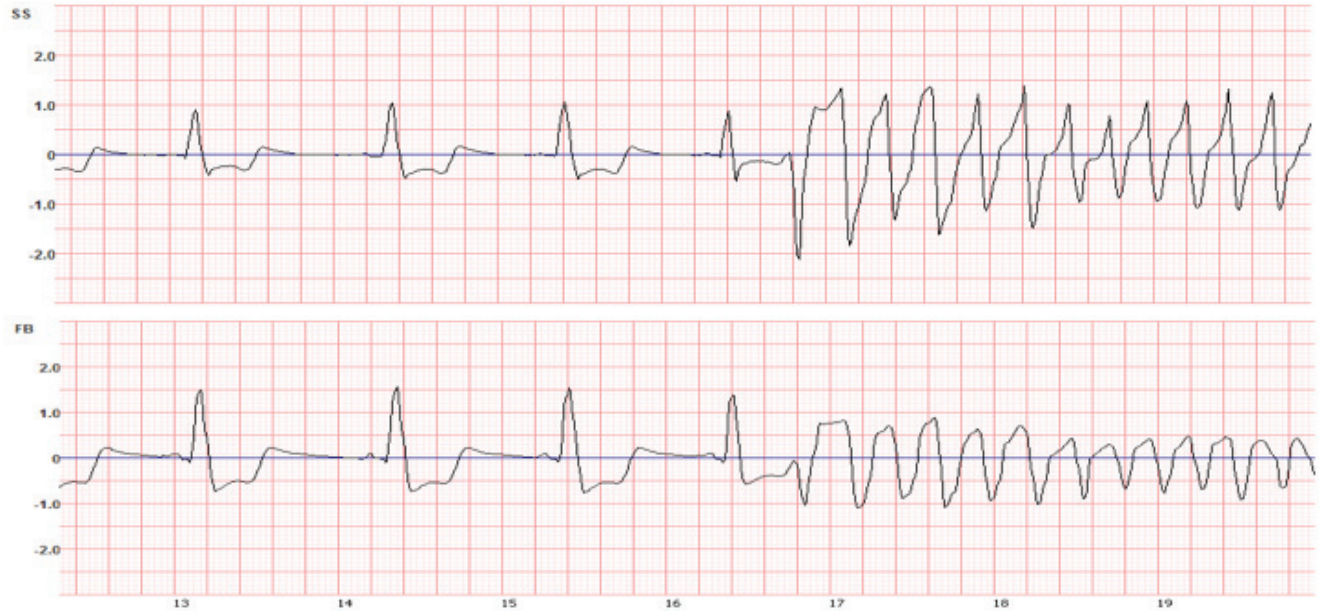

Figure 1: ECG downloaded from the WCD. The WCD continuously monitors the patient's ECG using a 4 electrode, 2 lead system: side-to-side (SS, top) and front-to-back (FB, bottom)

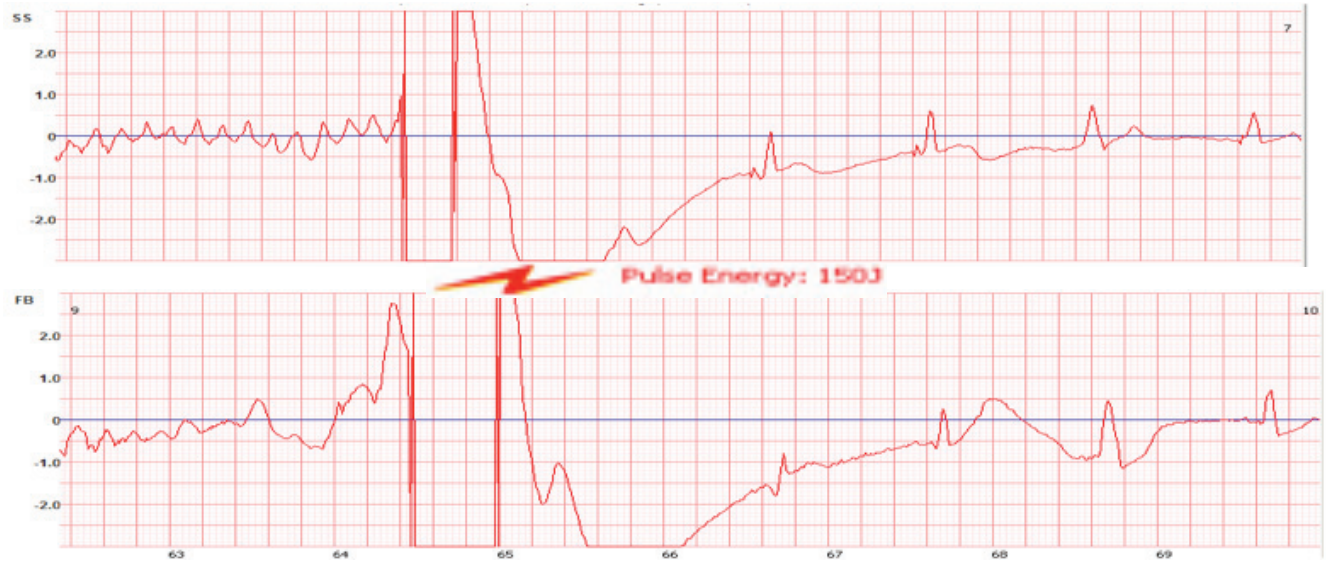

Figure 2: ECG downloaded from WCD displaying a 150J biphasic treatment shock which successfully converted the patient's VF to a normal sinus rhythm at a rate of 61 BPM.

Written by James Strickland with support from ZOLL.

Extraction Procedure

The device was removed and the RV lead was successfully extracted. Testing of the LV lead showed it to be non-functioning and it was also extracted. Finally, the right atrial lead was damaged due to extensive adhesion and manipulation of the RV and LV leads and also required extraction. Following the removal of all the leads and the device, the original left side generator pocket was flushed with an antibiotic solution and closed with plans to re-implant on the right side the following day.

The patient received antibiotics overnight and was implanted with a new BI-V ICD system the next day. All the leads were tested and found to be within normal limits (Table 2). The patient was transported to a recovery unit and the device was programmed. The patient tolerated the procedure well and was discharged to home.

Table 2: Testing thresholds at implant

	Atrium	RV	LV
Sensing	.9	25.7	25.1
Impedance	470	633	538
Threshold	.5	.5	1.3
Pulse Width	.5	.5	.5

Discussion

This patient had a normal functioning RV lead which was under recall and being monitored during normal device follow-up. Attempts to remove the RV lead during a generator change out at ERI was unsuccessful due to adhesions at the site of the SVC coil. When the lead later failed, it was determined that scheduling the patient for a lead extraction was required and, to prevent further inappropriate shocks, the detections of the BI-V ICD were programmed off. Complicating the case, the lead extraction procedure was not available at the admitting hospital.

Managing sudden cardiac arrest (SCA) risk when the clinical situation does not permit ICD protection adds complexity to patient care. These situations can be caused by ICD lead/device malfunctions, ICD waiting periods, ICD implant delays due to health risks or infections, and surgery schedules at specialized institutions. Other factors can include patient preferences, geographic location, and patient life events. Options often include emergency surgery, prolonged hospitalizations, and making difficult choices concerning discharging patients unprotected. This case illustrates how this patient's risk of SCA was successfully managed by the use of a WCD during the period between lead malfunction and the lead extraction/replacement procedure.