Journal of Arrhythmia 30 (2014) 119–122

Contents lists available at ScienceDirect

Journal of Arrhythmia

journal homepage: www.elsevier.com/locate/joa

Case Report

Shock-induced failure of a Riata lead with normal electrical lead parameters and a normal fluoroscopic appearance: A case report

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ARTICLE INFO

Article history:
Received 22 April 2013
Received in revised form
15 June 2013
Accepted 9 July 2013
Available online 17 September 2013

Keywords:
Riata lead
Lead failure
Insulation breach
Defibrillation

ABSTRACT

An 81-year-old man was scheduled for an elective implantable cardioverter defibrillator (ICD) generator exchange because of battery depletion. The Atlas™+ DR ICD (St. Jude Medical, Sylmar, CA) had been implanted in February 2007 for primary prevention. The ICD lead (Riata 1570, St. Jude Medical, Sylmar, CA) had been positioned via the left cephalic vein at the right ventricular apex. Prior to the ICD generator exchange, which took place 70 months after the initial implantation, all routine device interrogations revealed normal electrical lead parameters, and cine-fluoroscopy of the lead showed normal appearance without any apparent fracture. We attempted to conduct high-voltage shock testing, as there was concern about the possibility of silent lead malfunction. Following delivery of the first high-voltage shock, the device declared "possibility of output circuit damage." Subsequent shocks could not be delivered. Nonetheless, other lead parameters remained stable, and high-voltage lead impedance was $<20\ \Omega$. The following day, the failed generator was replaced with a new ICD generator and connected with a new ICD lead. We then tested the new device by inducing ventricular fibrillation, which was defibrillated successfully. Although electric screening in asymptomatic patients with the Riata ICD lead remains controversial, it should be remembered that there are patients with or without detected cable externalization in whom only high-voltage shock testing can disclose lead malfunction. Issues with Riata leads have not yet been elucidated in full detail.

1. Introduction

Failure of an implantable cardioverter defibrillator (ICD) to deliver therapy for sustained ventricular tachycardia (VT) or ventricular fibrillation (VF) can result in fatality. Recently, there has been great concern over Riata lead insulation breaches. There have been reports of insulation breaches with or without externalization of conductors in the Riata family of leads [1–7]. There is also considerable debate about how to manage patients with an electrically silent Riata lead malfunction with or without a fluoroscopically detected insulation breach. We report a case of an apparently normal ICD lead that failed to deliver shock during high-voltage shock testing.

2. Case report

An 81-year-old man with ischemic cardiomyopathy underwent ICD implantation for primary prevention in February 2007. The patient had never experienced spontaneous VF. A Riata™ 1570 dual-coiled lead (St. Jude Medical, Sylmar, CA) was passed through the left cephalic vein and connected to an Atlas™+ DR ICD (St. Jude Medical, Sylmar, CA). High-voltage lead impedance was 44 Ω when a 5-Joule shock was inappropriately delivered due to sinus tachycardia 55 months earlier. Electrical lead parameters did not change before and after shock delivery. Over the preceding 10 months, all in-clinic routine device interrogations showed normal and stable sensing amplitudes (range 8.7–9.4 mV), pacing lead impedances (range 335–370 Ω), and capture thresholds (range 1.25–1.5 V/1.0 ms) (Fig. 1). Because this generator model did not allow for pain-free lead integrity testing, we did not examine high-voltage lead impedance except through the earlier inappropriately delivered shock. At 70 months post-implant follow-up, the patient was scheduled for ICD generator replacement because of battery depletion. Cine-fluoroscopy of the entire length of the lead conducted prior to exchanging the generator showed normal appearance without any apparent separation (Fig. 2). In order to detect possible lead-to-can abrasion, we manipulated the pocket during lead measurement, but found normal electrical lead parameters.

We have been aware that defibrillation threshold (DFT) testing in this situation has been controversial [1,8]. However, as we were concerned about the possibility of lead malfunction despite an

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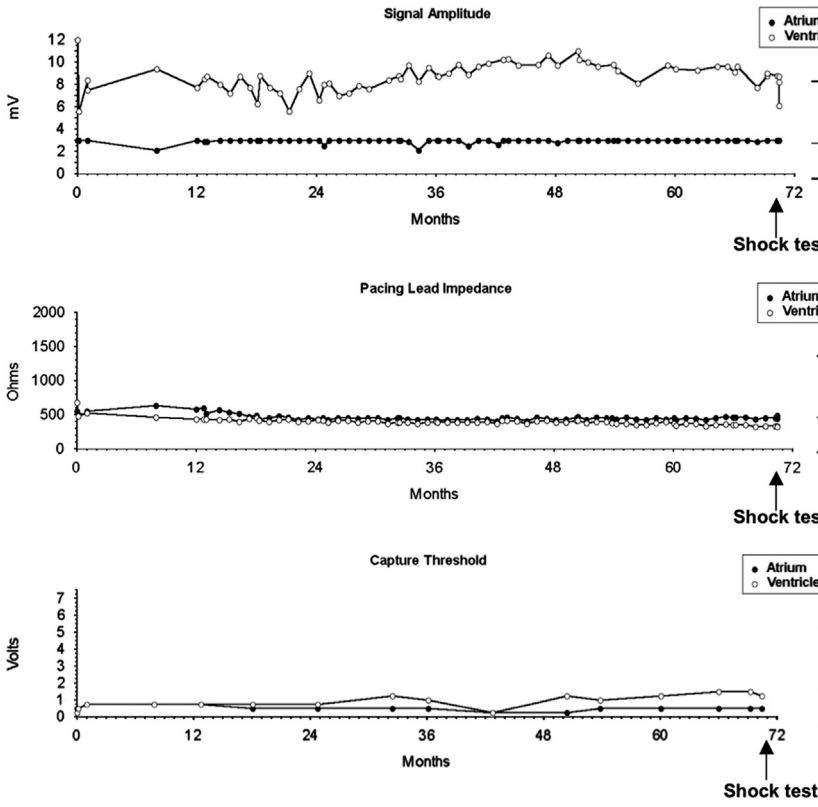
http://dx.doi.org/10.1016/j.joa.2013.07.006



R-wave amplitude

10 months Before (mV)	Last Clinic (mV)	At shock Testing (mV)	1 day After (mV)
9.4	8.8	8.7	6.1 ↓

Pacing lead impedance

10 months Before (Ω)	Last Clinic (Ω)	At shock Testing (Ω)	1 day After (Ω)
370	335	335	330

Capture threshold

10 months Before (Volts)	Last Clinic (Volts)	At shock Testing (Volts)	1 day After (Volts)
1.25	1.50	Not measured	1.25

Fig. 1. Serial electrical lead parameters are shown (upper, R-wave amplitude; middle, pacing lead impedance; bottom, capture threshold). All routine device interrogations in the outpatient clinic had been within normal range, with sensing amplitude 8.7–9.4 mV, pacing lead impedance 335–370 Ω, and capture threshold 1.25–1.5 V/1.0 ms over the preceding 10 months. After shock testing, intra-cardiac R-wave amplitudes abruptly decreased despite stable pacing impedance and capture threshold.

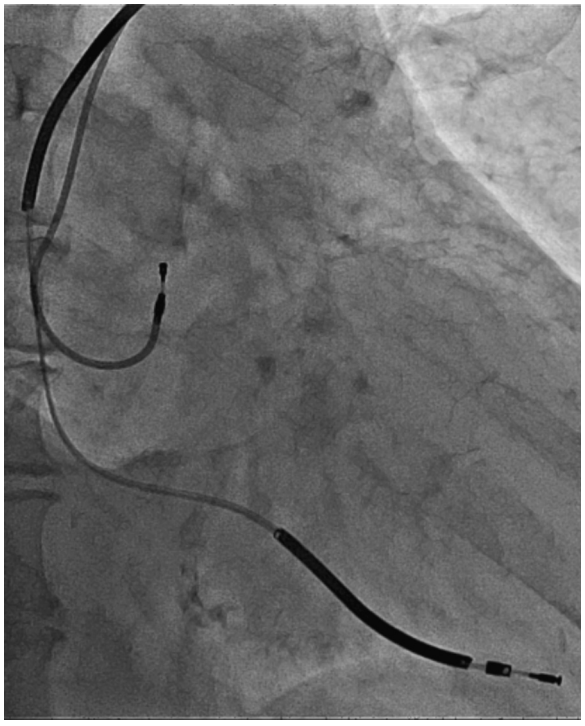


Fig. 2. Cine-fluoroscopy showed no fluoroscopic evidence of cable extrusion between the proximal and distal coils, as with other portions of the lead.

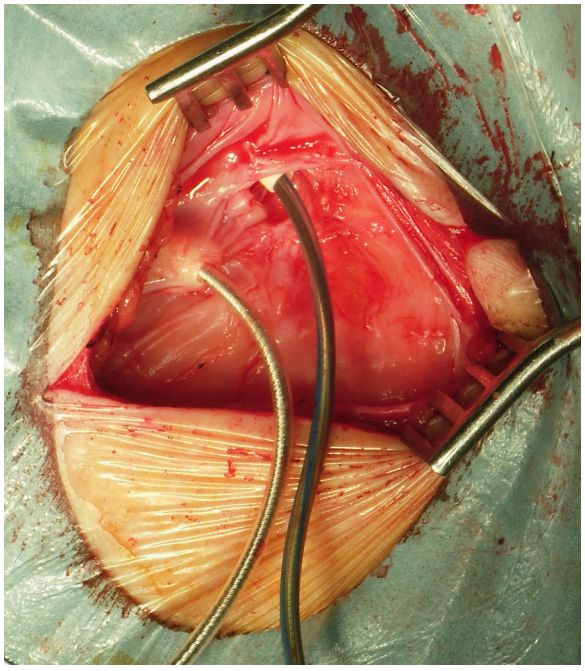


Fig. 3. No charring was apparent in the pocket area.

unremarkable interrogation showing a sensing amplitude of 8.7 mV, pacing lead impedance of 335 Ω, and a capture threshold of 1.5 V/1.0 ms, we attempted to deliver a 36-Joule test shock. The shock was delivered on the patient's intrinsic R-wave without inducing VF to see if it would unmask a potential insulation defect. After the first delivery, the device declared "possible output circuit damage." Subsequent shock could not be delivered owing to a fault in the pulse generator or lead. High-voltage lead impedance was consistently below 20 Ω, suggesting post-shock development of high-voltage cable abrasion. On the following day, the patient