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Case Report

Riata lead failure presenting as a life-threatening electrical storm: A novel manifestation of electrical lead failure

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ABSTRACT

The Riata and Riata ST family of implantable cardioverter-defibrillator leads are prone to a unique type of structural failure involving exteriorization of the conductor cables, which may present as electrical failure. We report a mode of lead failure that occurred in a patient with a Riata 1570 series dual coil 8F lead. In this case, the first appropriate shock for ventricular fibrillation resulted in noise, that in turn led to recurrent inappropriate shocks and proarrhythmia, that clinically mimicked a life-threatening electrical storm.

1. Introduction

The Riata and Riata ST family of 8-F and 7-F implantable cardioverter-defibrillator (ICD) leads are prone to failure involving exteriorization of the conductor cables. This resulted in a class I recall in December 2011 [1]. Lead failure is the result of a breakdown of the structural integrity of the lead that may, or may not, present with abnormalities of electrical parameters. Here we report a unique mode of electrical failure that occurred in a patient with a Riata 1570 series dual coil lead. In this case, the first appropriate shock for ventricular fibrillation (VF) resulted in noise that in turn led to a series of inappropriate shocks mimicking an electrical storm leading to near-death.

2. Case report

A 59-year-old man with a single chamber ICD implanted in 2006 for secondary prevention (Epic VR V-197 with 8F RIATA 1570 dual coil lead, St Jude Medical) presented to a peripheral hospital with repetitive ICD shocks over a 3-h period, which had resulted in loss of consciousness. On admission, he was noted to have pulseless VF, for which a successful external rescue defibrillation was performed, along with intravenous amiodarone infusion. He was transferred to our hospital on a ventilator owing to the occurrence of electrical storm.

Intracardiac electrograms were examined and they revealed that a total of 36 shocks had been delivered to the patient (Fig. 1). The first appropriate successful shock delivered 17.5 J for VF (Fig. 1a). The ICD was programmed to 2 ventricular tachycardia (VT) zones (VT1 < 360 ms, VT2 < 320 ms) and a VF zone (< 280 ms). After the first successful shock, noise was detected, which was classified as VF resulting in an inappropriate shock (Figs. 1b and c). Repeated inappropriate shocks, delivered in response to noise, resulted in VT. This in turn resulted in further shocks, finally degenerating to VF (Fig. 1c).

Further investigation of the ICD provided more clues. Electrical lead parameters were assessed and revealed a threshold of 0.5 V at a pulse width of 0.4 ms, sensed R waves of 9 mV, high voltage lead impedance of 35 Ω, and pacing impedance of 545 Ω. Thus, there had not been any significant sudden changes in the electrical lead parameters prior to the presenting episode (Fig. 2). Repeated shocks had also increased the defibrillator charge time (to > 28 s) and depleted the battery voltage (to < 2.45 V), indicating an elective replacement interval (ERI) state. Fluoroscopic evaluation of the lead showed exteriorization of cables at the tricuspid annulus (Fig. 3).

Three days later, once the patient regained consciousness with no major neurological sequelae, a new lead and defibrillator was implanted for device ERI (Sprint Quattro lead and Protecta XT,

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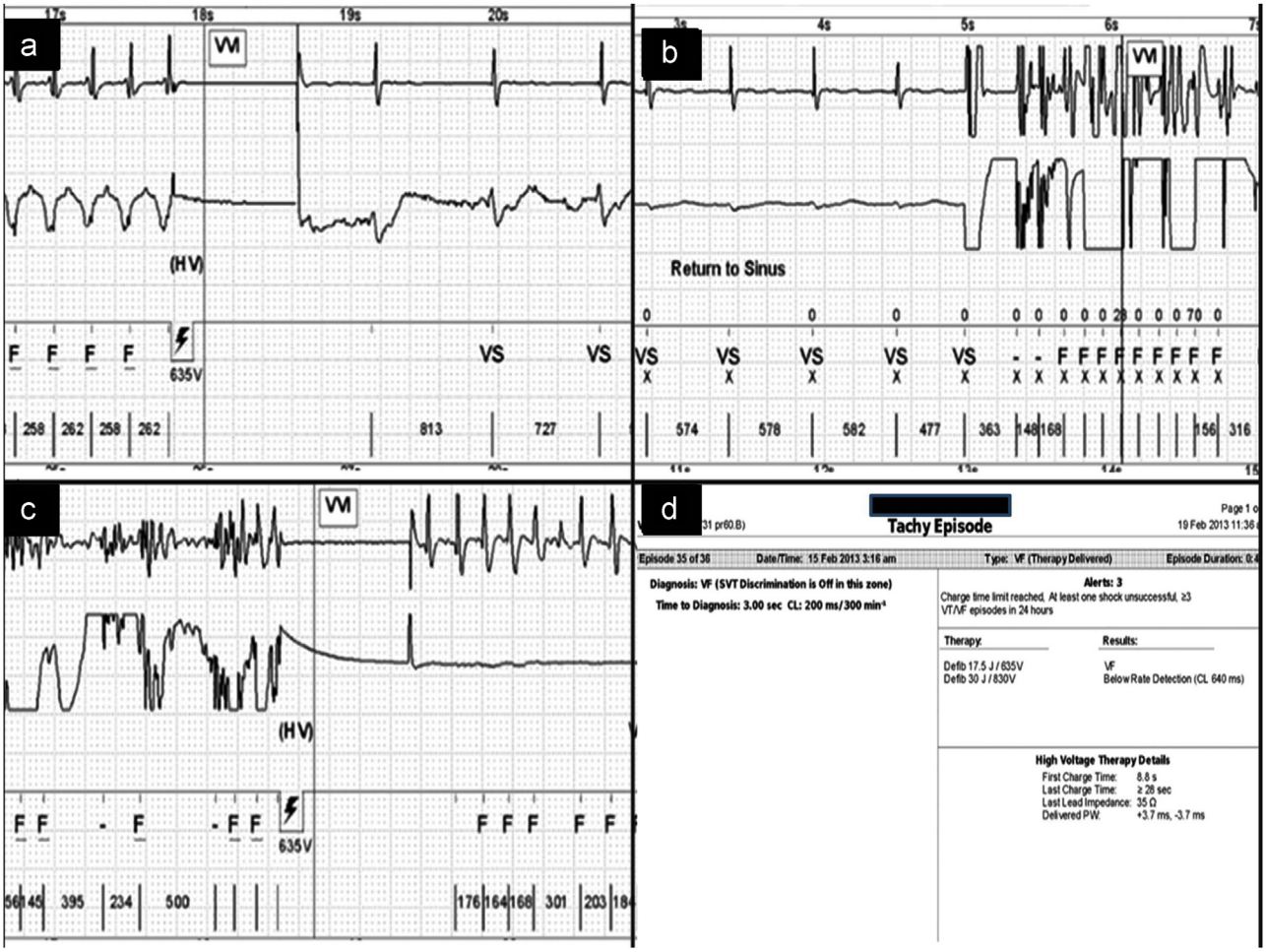

Fig. 1. Intracardiac electrograms. (a) Regular tachycardia at 260 ms was binned as fibrillatory complexes and reverted to sinus rhythm after a high voltage shock. (b) Noise in sinus rhythm was binned as fibrillatory complexes. (c) Inappropriate shock, delivered in response to noise, initiates ventricular fibrillation. (d) Episode summary 35: showing a prolonged charge time (> 28 s). F, fibrillatory complexes; VS, sinus rhythm; HV, high voltage shock; VT, ventricular tachycardia; and VF, ventricular fibrillation.

Medtronic). The patient has remained in NYHA class I at the 6-month follow-up with no documented ventricular arrhythmias, and is on standard medical therapy for left ventricular dysfunction.

3. Discussion

Duray et al. and Richards et al. reported a form of Riata lead failure that involved exteriorization of the lead cables ('inside out'), which was a fluoroscopy finding noted in patients with abnormal lead parameters [1,2]. This was confirmed in subsequent single-center studies and various national registries, that ultimately led to a class I recall of Riata leads issued by St. Jude Medical in December 2011 [3–5].

Lead failures are classified as either structural lead failures or electrical lead failures, and failures of 8F single coil leads are more frequently reported. Structural failures occur with a reported incidence of 14–34% and are evident as cable exteriorization in fluoroscopy studies [6,7]. Electrical failure is seen in 2–6% of leads with structural failure [3]. Electrical failures may present as a sudden rise in capture threshold, a change in impedance, oversensing due to noise, inappropriate shocks, failure to deliver defibrillation therapy, or a decrease in R wave amplitude. Inappropriate shocks occur in 15–24% of leads with electrical failures [3,5,8].

An unusual feature in the present case is that the occurrence of noise after the first high voltage shock resulted in multiple shocks mimicking an electrical storm that was nearly fatal. Fluoroscopy revealed a structurally abnormal lead with conductor exteriorization. There was no change in electrical parameters. The exact mechanism by which a high voltage shock led to an electrical failure in an aging lead with stable electrical parameters is unknown. A case in which noise followed a high-energy shock during defibrillation testing in a patient with a Riata lead has been described earlier [3]. This event was attributed to a complete breakdown of the ethylene tetrafluoroethylene coating around the conductor, induced by a high voltage shock, due to partial abrasions in the coating. It is possible that the high voltage shock precipitated an electrical failure in our patient by a similar mechanism in a lead with a preexisting asymptomatic mechanical failure (conductor exteriorization).

Monitoring of Riata leads with regular fluoroscopy has been recommended to identify early structural defects. However, there is still a debate regarding the appropriate strategy for the clinical management of asymptomatic patients who present with conductor exteriorization and normal lead parameters. It is still unclear whether a conservative approach with frequent monitoring of electrical parameters should be adopted in such patients in comparison to a more aggressive approach of abandoning/replacing the defective lead with another lead. This report highlights the importance of frequent fluoroscopy to identify structural failures in Riata leads (even those with normal electrical parameters) as structural failures may be asymptomatic and may become evident only during the evaluation of an electrical failure.