

Partial Fracture of a Subcutaneous ICD Lead from Mechanical Trauma

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Abstract

Transvenous implantable cardioverter-defibrillators (TV-ICD) have electrode failure rates as high as 20% over a 10 year followup with 12% as a result of lead fractures. [1] The development of the Boston Scientific subcutaneous ICD (S-ICD) promoted the benefit of significantly reduced post-implant complication rates. [4] We present the first reported case of a S-ICD electrode failure secondary to partial fracture as a result of mechanical trauma.

Keywords: subcutaneous ICD; lead fracture; electrode failure

Background

Implantable cardioverter defibrillators (ICD) are life saving devices that monitor and treat fatal ventricular arrhythmias. Indications for an ICD broadly include a secondary prevention population who have survived prior cardiac arrest, sustained VT/VF, or syncope caused by ventricular arrhythmia and a primary prevention population who are at an increased risk of fatal ventricular arrhythmias.[2] ICD technology has progressed since first developed by Dr. Mirowsky. The development of the subcutaneous ICD system allowed for the implantation of an ICD system without the need for placement of the ICD lead transvenously with the traditional transvenous ICD (TV-ICD) systems. S-ICDs bypass the TV-ICD complications which include lead dislodgement, lead fracture, externalization, embolization, insulation break, and tricuspid valve damage.[5] S-ICD systems are safe and effective. S-ICDs are recommended for patients who meet criteria for a TV-ICD but do not have vascular access or at high risk of infection. [2,3] Boston Scientific's Emblem S-ICD has very low post implant complication rates, which is limited to localized infection or hematoma. [4] Recently, there was a single case report of electrode failure due to cable externalization. [6]

Learning Objective

1. To report the first S-ICD lead fracture.
2. To demonstrate the benefit of a remote monitoring system
3. To demonstrate the importance of a 2 view chest x-ray in a patient with a S-ICD after mechanical fall or thoracic trauma.

Case Presentation

A 54 year old male with a past medical history of ischemic cardiomyopathy and heart failure with reduced ejection fraction (HFrEF) of 15% who was implanted with a Boston Scientific Emblem S-ICD for primary prevention after his initial TV-ICD was explanted due to a lead infection. The patient arrived at the emergency department status post a mechanical fall and was discharged on the same day. The patient's home monitoring system notified us that the impedance of his defibrillation electrode was greater than 400 ohms, suggesting a lead fracture. A two view chest x-ray confirmed that the S-ICD lead fracture proximal to the defibrillation coil (**Figure 1 and Figure 2**). This fracture is most evident on the lateral view chest x-ray (**Figure 1**).

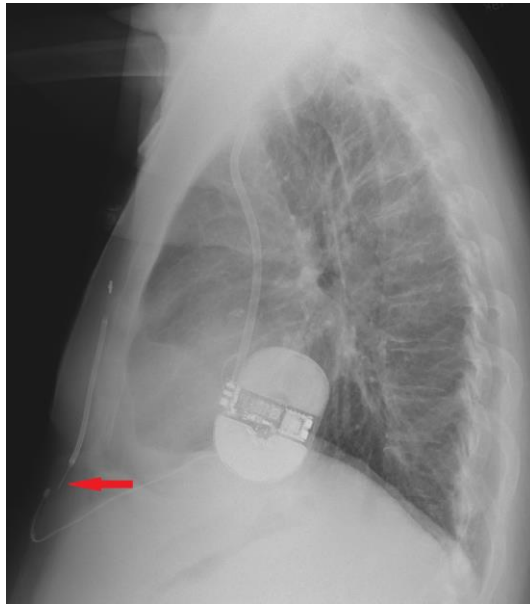


Figure 1: Left lateral chest x ray view of S-ICD lead fracture. Red arrow points to the lead fracture.

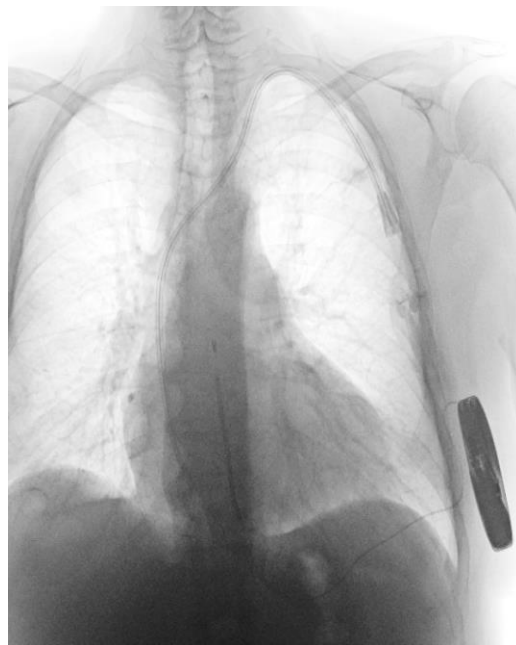


Figure 2: AP chest x ray view of SICD fracture.

The sensing component of the lead remained intact as shown in (**Figure 3a and 3b**). Comparing the electrogram before and after the chest trauma shows no change.

Presenting S-ECG (May 24, 2019 22:44 EDT)

S-ECG displayed at 25 mm/sec 2.5 mm/mV

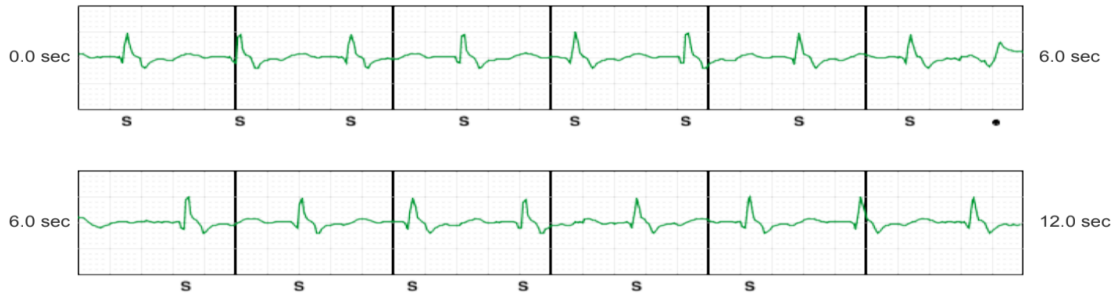


Figure 3a

Presenting S-ECG (Aug 29, 2019 13:36 EDT)

S-ECG displayed at 25 mm/sec 2.5 mm/mV

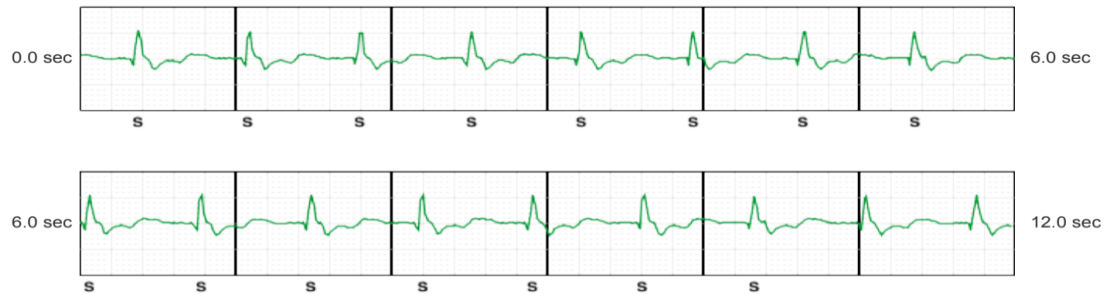


Figure 3b

Figure 3a shows a subcutaneous electrocardiogram from the sensing electrodes of the S-ICD before the date of the mechanical trauma. Figure 3b shows a subcutaneous electrocardiogram from the sensing electrodes of the S-ICD after the date of the mechanical trauma. This demonstrates that the cable of the sensing electrode of the fractured lead remains intact post mechanical fall.

During lead extraction, the S-ICD was severed completely and removed in two pieces with manual traction at the most proximal end of the lead. A new S-ICD lead was then successfully re-implanted.



Figure 4: Emblem S-ICD lead fracture post explantation.

Discussion

Transvenous ICD/pacemaker lead fractures are a known complication secondary to chronic tension and stress from repetitive cardiac and thoracic movement, subclavian crush, twiddler syndrome, thoracic trauma, thoracic outlet syndrome and multiple other etiologies.[7-9] Post operative S-ICD implant complication rates are low and generally limited to localized infection and hematoma. [4] To date, there has only been a single case report of an S-ICD lead externalization demonstrating potential lead complications, however, there has not been any reported cases of a S-ICD lead fracture.

This case demonstrates that S-ICD leads are in fact susceptible to fracture. Direct mechanical trauma to the chest was the most likely cause of lead fracture and associated stretching of the lead from the fall likely contributed to the fracture as it occurred just beyond the retaining suture. As the sensing function was still intact, there was a selective fracture of the defibrillator coil. This case also illustrates the importance of home monitoring. The patient was unaware of damage sustained to the S-ICD lead from the fall which could have led to failure of appropriate defibrillation therapy in the future.

Conclusion

Complications related to S-ICD implantation have been limited to localized infection and hematoma. We report the first known case of a partially fractured S-ICD lead secondary to mechanical trauma confirmed with a two view chest x-ray and elevated impedance (>400 ohms) readings on the patient's home monitoring system.

Disclosures:

Hieu Huynh D.O.: None

Gregory P. Siroky M.D.: None

Devendra Bisht M.D.: None

Patrick Lam M.D.: None

Asad Mohammad D.O.: None

Devendra Mehta M.D. Ph.D.: None

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