

Available online at www.sciencedirect.com

ScienceDirect

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

Case Report

A broken lead to an open heart: implantable cardioverter defibrillator vegetations with lead fracture ☆,☆☆,★

George Horani, MD^{a,*}, Kevin Hosein, MD^b, Rahul Kumar, MD^b, Fayez Shamoon, MD^b

^a Department of Internal Medicine, St. Joseph's University Medical Center, 703 Main St., Paterson, NJ 07503

^b Department of Cardiology, St. Joseph's University Medical Center, 703 Main St., Paterson, NJ 07503

ARTICLE INFO

Article history:

Received 22 July 2021

Revised 25 July 2021

Accepted 25 July 2021

Available online 26 August 2021

Keywords:

Implantable cardioverter defibrillator

Thrombus

Lead fracture

ABSTRACT

Implantable cardiac devices are widely used devices that serve several purposes. Complications from devices are not uncommon and include localized or systemic infections, device-related endocarditis, and device malfunction leading to serious outcomes, including death. Another possible complication that has been reported in the literature is thrombus formation on the device leads. We present a rare case of large thrombi forming on the leads of an implantable cardioverter defibrillator leading to lead fracture and device malfunction. After the device alerted for malfunction, the patient underwent a transesophageal echocardiogram which demonstrated masses on the right atrium and ventricle. He subsequently had a right atrial exploration and lead extraction which revealed large thrombi on the leads which histologically were identified as sterile vegetations.

© 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington.

This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Introduction

Implantable cardioverter defibrillators (ICDs) are devices that serve several purposes, mainly for the identification and treatment of life-threatening arrhythmias such as ventricular tachycardia or fibrillation which can lead to sudden cardiac death. Short and long-term complications from ICD placement include infection, bleeding, device malfunction, lead

fracture, and rarely, death due to pulseless electrical activity [1]. Device-related infective endocarditis has been a well-known phenomenon in patients with ICDs, and treatment involves antibiotics and hardware removal. However, the growth of sterile vegetations on cardiac device leads is a relatively rare but previously described event. Depending on the size of the thrombus, it is usually treated with anticoagulation or thrombolysis [2,3]. Limited data exists on thrombi-related lead fracture.

☆ Acknowledgements: None

☆☆ Competing Interests: None

★ Patient consent: Written informed consent for publication of this case was obtained from the patient himself.

* Corresponding Author.

E-mail address: georgebhorani@gmail.com (G. Horani).

<https://doi.org/10.1016/j.radcr.2021.07.059>

1930-0433/© 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

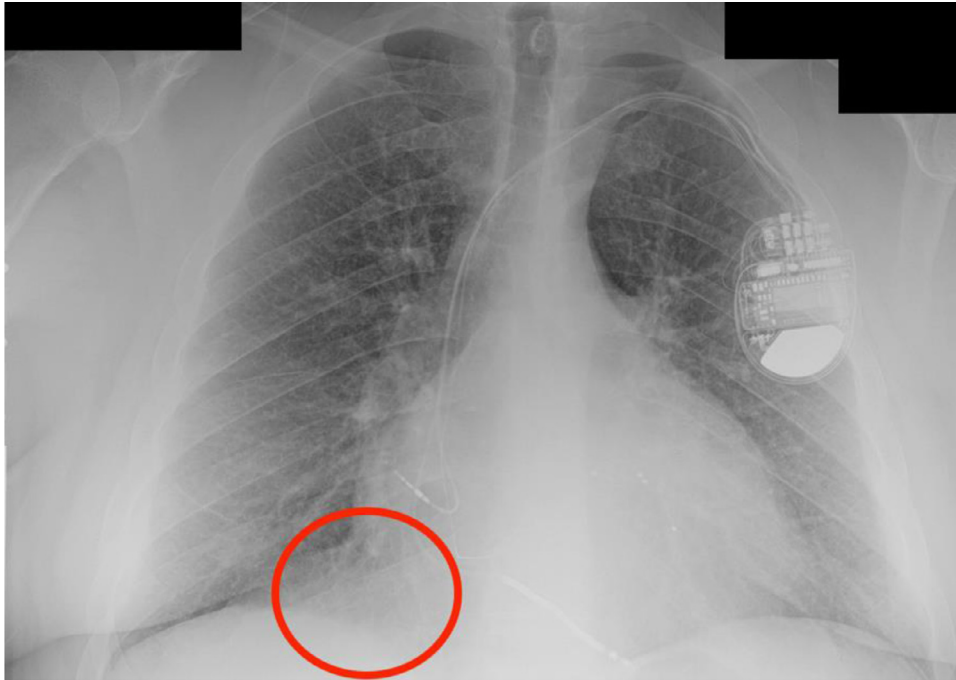


Fig. 1 – Chest x-ray in posteroanterior view showing the ICD in place and the right lung base opacity.

Case report

The patient is a 40-year-old male with a medical history significant for non-ischemic cardiomyopathy with severely reduced left ventricular ejection fraction of 20%-25% requiring a biventricular implantable cardioverter defibrillator (ICD) in 2017 who presented to the hospital for replacement of an ICD lead after the device alerted for a fractured coil. Chest x-ray in posteroanterior view showed the ICD in situ with a right lung base opacity/density which may represent a mass (Fig. 1). The patient underwent a transesophageal echocardiogram (TEE) prior to the lead extraction which demonstrated extensive mobile masses adhering to the right atrium and right ventricle, each measuring approximately 2 cm in size and concerning for thrombi or vegetations (Fig. 2-3). The procedure was aborted, and the patient was referred to cardiothoracic surgery for an open extraction and evaluation of the lead and masses. At that time, the patient was afebrile with a temperature of 36.4 degrees Celsius, heart rate of 79 beats per minute, and a blood pressure of 165/94 mmHg; the rest of the physical exam was unremarkable, including cardiac exam which did not reveal any murmurs or gallops. His complete blood count showed only thrombocytopenia with platelet count of 79,000/mm³ (140-440K/mm³) and a normal white blood cell count of $10.5 \times 10^3/\text{mm}^3$ ($4.5 - 11.0 \times 10^3/\text{mm}^3$). He was not on any antiplatelet or anticoagulant agents prior. Broad spectrum antibiotics Vancomycin and Piperacillin-Tazobactam were started, and blood cultures were obtained. They subsequently grew *Staphylococcus epidermidis* in only one bottle. This was attributed to skin contamination and the antibiotics were discontinued.

The patient subsequently had right atrial exploration by the cardiothoracic surgery team with removal of the ICD leads and generator, which revealed soft vegetative tissue overlying the wires (Fig. 4). Cultures from the cardiac tissue were obtained and were negative for any bacterial growth. The pathology of the vegetative tissue was found to be a sterile fibrinous vegetation with prominent calcification. The patient was extubated after the procedure and was discharged home a few days later with a wearable cardioverter defibrillator.

Discussion

An ICD is a device that helps identify and treat arrhythmias, mostly ventricular arrhythmias. It consists of 3 components – a generator which identifies the rhythms and need for cardioversion or defibrillation, the leads which conduct the electric activity between the device and myocardium, and the shocking coil which delivers the charge.[1] There are several indications for ICD placement, for the goal of both primary and secondary prevention of sudden cardiac death from life-threatening arrhythmias, such as ventricular fibrillation or ventricular tachycardia.[4] Complications resulting from ICD placements are rare. Overall, the prevalence of complications is up to 4% and can be divided into short-term and long-term. Short-term complications can be related to access (such as bleeding, vein thrombosis, or pneumothorax), the pocket (pain or hematoma), device-related infection (1%-2%), and very rarely, pulseless electrical activity and death (<1%). Long-term complications (up to 4%) include device-related pain, lead fracture, inappropriate shock delivery, phantom

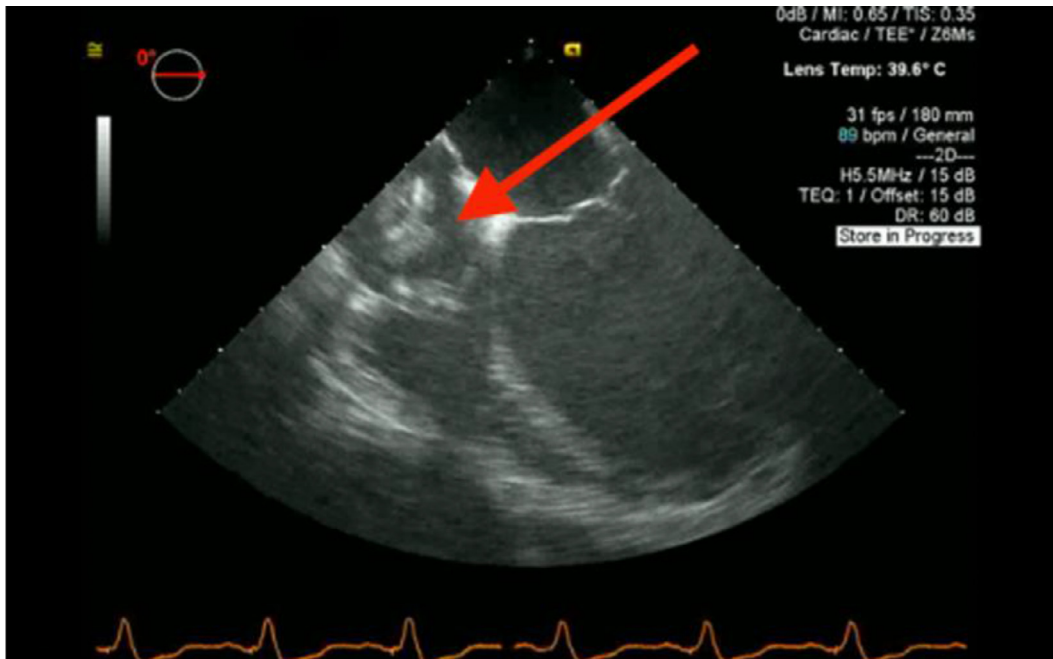


Fig. 2 – TEE mid-esophageal 4-chamber view demonstrating large mass in the right atrium.

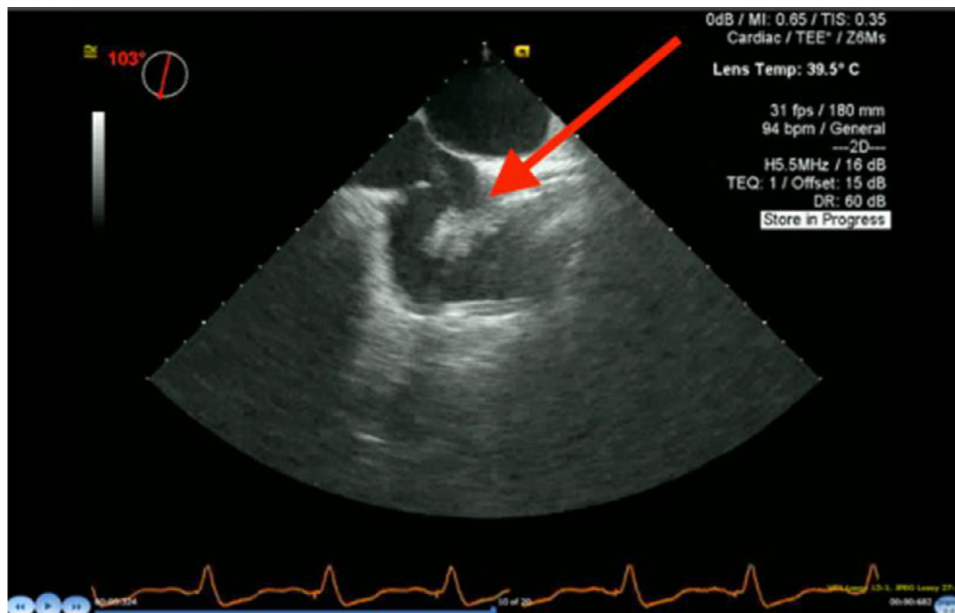


Fig. 3 – TEE bicaval view demonstrating mass adherent to ICD lead.

shock, device erosion, device infection, and immunologic rejection.[1,5] Device infection can have different presentations, including local pain, erythema, tenderness, and swelling, fever without local changes, bacteremia without local changes, or a lead thrombus or vegetation seen on echocardiography.[6] Cardiac device-related infective endocarditis has been described in the literature, and management involves both removal of the hardware and treatment with antibiotics.[7,8]

Although rare, sterile thrombus formation on implantable cardiac devices is not negligible and the incidence has been

reported to be around 1.4% on transthoracic echocardiography.[2,3] The proposed mechanism of thrombus formation is altered blood flow and platelet aggregation around the foreign body leading to fibrin deposition. The treatment for asymptomatic thrombosis varies based on individual circumstance. Small thrombi may be treated with anticoagulation while larger ones may require thrombolysis.[2] In our case, the thrombi were large and caused lead fracture, requiring total extraction of the device and leads.



Fig. 4 – Intraoperative photo demonstrating explanted ICD lead with adherent large mass.

In this case report, our aim is to highlight the rare occurrence of lead fracture from a sterile vegetative growth causing device malfunction. Given its low incidence of detection on TTE, we do not recommend routine cardiac ultrasound to assess for vegetations in the absence of any clinical or otherwise device malfunction signs and symptoms. Rather, we suggest maintaining a high clinical suspicion and timely intervention with TEE and possible surgery to restore ICD function can be lifesaving.

REFERENCES

- [1] Iqbal AM, Butt N, Jamal SF. Automatic internal cardiac defibrillator. [updated 2020 Jun 3]. StatPearls [Internet]. Treasure Island (FL). StatPearls Publishing; Jan 2021.
- [2] Monzo L, Silvetti E, Maresca L, Della Bona R, De Ruvo E, Calò L. A walking thrombus. *Acta Cardiol Sin* 2020;36(1):81–3. doi:10.6515/ACS.202001_36(1).20190823A.
- [3] Buttigieg J, Asciak R, Azzopardi CM. Pacemaker lead-associated thrombosis in cardiac resynchronisation therapy. *BMJ Case Rep* 2015 2015:bcr2015210314. Published 2015 Jul 7. doi:10.1136/bcr-2015-210314.
- [4] Kusumoto FM, Calkins H, Boehmer J, Buxton AE, Chung MK, Gold MR, et al. HRS/ACC/AHA expert consensus statement on the use of implantable cardioverter-defibrillator therapy in patients who are not included or not well represented in clinical trials. *Circulation* 2014;130(1):94–125.
- [5] Ezzat VA, Lee V, Ahsan S, et al. A systematic review of ICD complications in randomised controlled trials versus registries: is our 'real-world' data an underestimation? *Open Heart* 2015;2(1):e000198 Published 2015 Feb 17. doi:10.1136/openhrt-2014-000198.
- [6] DeSimone DC, Sohail MR. Approach to diagnosis of cardiovascular implantable-electronic-device infection. *J Clin*

- Microbiol 2018;56(7) e01683-17. Published 2018 Jun 25.
doi:[10.1128/JCM.01683-17](https://doi.org/10.1128/JCM.01683-17).
- [7] Sohail MR, Uslan DZ, Khan AH, et al. Infective endocarditis complicating permanent pacemaker and implantable cardioverter-defibrillator infection. Mayo Clin Proc 2008;83(1):46–53. doi:[10.4065/83.1.46](https://doi.org/10.4065/83.1.46).
- [8] Edelstein S, Yahalom M. Cardiac device-related endocarditis: Epidemiology, pathogenesis, diagnosis and treatment - a review. Int J Angiol 2009;18(4):167–72.
doi:[10.1055/s-0031-1278347](https://doi.org/10.1055/s-0031-1278347).