CASE REPORT

Unexpected early complication of implantable-cardioverter defibrillator

Ahmed Abdelhafez,¹ Nancy Wassef,² Kai Hogrefe,¹ Mohsin Farooq¹

¹Kettering General Hospital NHS Foundation Trust, Kettering, UK
²Cardiology Department, Royal Cornwall Hospitals NHS Trust, Truro, UK

Correspondence to
 Dr Nancy Wassef,
 nancy.wassef@gmail.com

Accepted 1 May 2018

SUMMARY

A 41-year-old woman was visiting Oxford, where she had a sudden cardiac arrest. Cardiopulmonary resuscitation was started by a bystander until the paramedics arrived, who found her in ventricular fibrillation, and delivered three shocks. After 28 min she had return of spontaneous circulation. Emergency coronary angiography revealed normal coronary arteries. Echocardiography followed by a cardiac MRI showed non-dilated left ventricles with no evidence of late gadolinium enhancement. She had a single-chamber implantable-cardioverter defibrillator (ICD). A chest CT showed sternal fracture and subsegmental pulmonary embolism, for which she was anticoagulated and was discharged. Several days later, the patient presented to another hospital with atypical chest pain and dizziness. She had haemodynamic instability and echocardiography showed the ICD lead perforating through the right ventricle, with a large pericardial effusion and tamponade, for which pericardiocentesis was done. Afterwards, the patient had repositioning of the ICD lead safely.

BACKGROUND

This patient had a complicated presentation, as she was on anticoagulant for a new-onset pulmonary embolism, which contributed to cardiac tamponade within several days after perforation caused by the ICD implant.

CASE PRESENTATION

A 41-year-old woman who was fit and well, with neither previous medical history nor on any medications, was visiting a friend in Oxford, where she had a sudden cardiac arrest. Cardiopulmonary resuscitation was started by a bystander, until the paramedics arrived and found her in ventricular fibrillation (VF), and delivered three shocks. After 28 min she had return of spontaneous circulation and was transferred to the nearest hospital.

INVESTIGATIONS

Emergency coronary angiography revealed normal coronary arteries. Echocardiography showed no significant abnormality, followed by a cardiac MRI which showed non-dilated left and right ventricles with no evidence of late gadolinium enhancement. There was a mild left ventricular systolic dysfunction. Chest CT showed sternal fracture and a subsegmental pulmonary embolism.

DIFFERENTIAL DIAGNOSIS

- ▶ Ventricular arrhythmia.
- ▶ Myocardial infarction.
- ▶ Cardiomyopathy.
- ▶ Spontaneous coronary dissection.
- ▶ Pulmonary embolism.

TREATMENT

She had a single-chamber implantable-cardioverter defibrillator (ICD) implanted for secondary prevention, for out-of-hospital ventricular arrhythmia causing cardiac arrest. The ICD BOSTON SCIENTIFIC Reliance 4-Front 0692, 7.3 French (Fr) lead was actively deployed to the right ventricular apex and was connected to an INOGEN BOSTON generator. Then, the patient was anticoagulated and discharged.

Afterwards, the patient had atypical chest pains and dizziness, with haemodynamic instability within few days of discharge, and presented to another general hospital. Echocardiography showed a large pericardial effusion with echocardiographic evidence of tamponade with right ventricular wall collapse in diastole ([figure 1](#)). The ICD lead was seen perforating through the right ventricle apical wall ([figures 2, 3](#)), and the patient had emergency pericardiocentesis with a pigtail catheter and she stabilised ([video 1](#)).

OUTCOME AND FOLLOW-UP

Afterwards, the patient had repositioning of the ICD lead with the surgical team on stand-by in case of a need for emergency open-heart surgery. The active lead was unscrewed and pulled back, then was repositioned and deployed safely. Periprocedure echocardiography was performed to assess pericardial fluid reaccumulation, there was no recurrence of effusion. The procedure was straightforward, and the patient had an uneventful recovery and was discharged home.

She was stable after 1 year follow-up.

DISCUSSION

The ICD is an established secondary prevention management for patients who have survived cardiac arrest by either ventricular tachycardia or VF,¹ in addition to primary prevention in individuals who are at an increased risk of sudden cardiac death.¹

However, there is a considerable risk of complications that has been identified in previous registries and randomised controlled trials (RCTs). The largest registry, the US National Cardiovascular

To cite: Abdelhafez A, Wassef N, Hogrefe K, et al. *BMJ Case Rep* Published Online First: [please include Day Month Year]. doi:10.1136/bcr-2018-224521

Figure 1 Transthoracic echocardiography, subcostal view showing pericardial effusion and right ventricle collapse.

Data Registry ICD registry that included 356 515 patients who had initial ICD implantation, was published in 2012.²

The registry complication rate was 3.08% and these included cardiac arrest, perforation, valve injury, coronary venous dissection, haemothorax, pneumothorax, deep vein thrombosis, transient ischaemic attack, stroke, myocardial infarction, pericardial tamponade, arteriovenous fistula, conduction block, lead dislodgement, haematoma, peripheral embolism, superficial phlebitis, peripheral nerve injury and device-related infection.²

However, a systematic review of ICD implantation in almost 6800 patients enrolled in RCTs, in recent years, found an overall complication rate of 9.1%, the majority of which arose from early complications of access issues or lead displacement (5.2%).³ This

Figure 2 Transthoracic echocardiography, four-chamber view showing implantable-cardioverter defibrillator lead in the right ventricle.

Figure 3 Zoomed image view showing implantable-cardioverter defibrillator lead perforating through the right ventricle wall.

was comparable to the more recently published Danish registry experience, with the total complication rate reported as 9.5%.⁴

Perioperative complications including lead dislodgement, pneumothorax, infections and bleeding tend to occur soon after implant, where lead-related problems can occur at any time during long-term follow-up.⁵ The vast majority of lead dislodgements occur within the first postoperative months.⁶ Pocket-related complications including skin erosion, haematoma and seroma, wound infection or device migration usually occur within the first 6 months after implantation.⁷ The transvenous lead systems present with lead fractures and insulation defects that may lead to inappropriate shocks.⁶ The necessity for operative revision is reported in 6% of patients within 1 year of initial implant and up to 15% of patients during 4 years.⁵

Ventricular lead perforation is a serious complication of ICD leads, although in many cases the perforations are asymptomatic. The lead perforation is usually a delayed complication that occurs after 1 month of implantation. Delayed lead perforation includes migration and perforation, with a complication rate ranging from 0.1% to 0.8% for pacemaker leads and 0.6% to

Video 1 Echocardiography showing the implantable-cardioverter defibrillator lead perforating through the right ventricle.

5.2% for ICD leads.⁸ Our case highlights the role of anticoagulation, which increased the risk of bleeding with perforation. Hence our patient presented with early perforation complication with cardiac tamponade.

Small-diameter (≤ 8 Fr), active-fixation leads were associated with a higher risk of cardiac perforation, in 1.6% of patients, and active-fixation leads in 1.4%.⁹ Female sex, age >80 years, lead location, lead stiffness and calibre size are risk factors for cardiac lead perforation.¹⁰

Learning points

- ▶ Perforation Complication rate occurs in 0.1%–0.8% for pacemaker leads and 0.6%–5.2% for ICD leads.
- ▶ Female sex, age >80 years, lead location, lead stiffness and calibre size are risk factors for cardiac lead perforation.
- ▶ Anticoagulation can increase risk of pacemaker and ICD complication, increasing the risk of bleeding with perforation and haematoma.

Correction notice AQ 1- Cardiology Department, Kettering General HospitalAQ2- Cardiology Department, Royal Cornwall HospitalCorrection

Contributors AA and NW had written and prepared the manuscript. KH and MF were supervising consultants.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

© BMJ Publishing Group Ltd (unless otherwise stated in the text of the article) 2018. All rights reserved. No commercial use is permitted unless otherwise expressly granted.

REFERENCES

- 1 National Institute for Health and Care Excellence. Implantable cardioverter defibrillators for arrhythmias. <http://guidance.nice.org.uk/TA95>
- 2 Freeman JV, Wang Y, Curtis JP, *et al*. Physician procedure volume and complications of cardioverter-defibrillator implantation. *Circulation* 2012;125:57–64.
- 3 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:e000198.
- 4 Kirkfeldt RE, Johansen JB, Nohr EA, *et al*. Complications after cardiac implantable electronic device implantations: an analysis of a complete, nationwide cohort in Denmark. *Eur Heart J* 2014;35:1186–94.
- 5 Kron J, Herre J, Renfro EG, *et al*. Lead- and device-related complications in the antiarrhythmics versus implantable defibrillators trial. *Am Heart J* 2001;141:92–8.
- 6 Alter P, Waldhans S, Plachta E, *et al*. Complications of implantable cardioverter defibrillator therapy in 440 consecutive patients. *Pacing Clin Electrophysiol* 2005;28:926–32.
- 7 Gold MR, Peters RW, Johnson JW, *et al*. Complications associated with pectoral cardioverter-defibrillator implantation: comparison of subcutaneous and submuscular approaches. worldwide jewel investigators. *J Am Coll Cardiol* 1996;28:1278–82.
- 8 Hermanides R, Ottervanger J, Elvan A, *et al*. Life-threatening perforation of a defibrillation lead. *Neth Heart J* 2009;17:113–4.
- 9 Rordorf R, Canevese F, Vicentini A, *et al*. Delayed ICD lead cardiac perforation: comparison of small versus standard-diameter leads implanted in a single center. *Pacing Clin Electrophysiol* 2011;34:475–83.
- 10 Cano Ó, Andrés A, Alonso P, *et al*. Incidence and predictors of clinically relevant cardiac perforation associated with systematic implantation of active-fixation pacing and defibrillation leads: a single-centre experience with over 3800 implanted leads. *Europace* 2017;19.

Copyright 2018 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow