

BELAL KASEER, MD
Dnipropetrovsk Medical Academy,
Dnipropetrovsk, Ukraine

MHD YASSIN AL MOUSLMANI, MD
Lincoln Medical and Mental Health Center,
New York, NY

DAVID S. HIRSH, MD
Assistant Professor of Medicine,
Department of Medicine, Emory University
School of Medicine, Atlanta, GA

MUHAMMAD HAMMADAH, MD
Department of Medicine, Division of Cardiology,
Emory University School of Medicine,
Atlanta, GA

A broken pacemaker lead in a 69-year-old woman

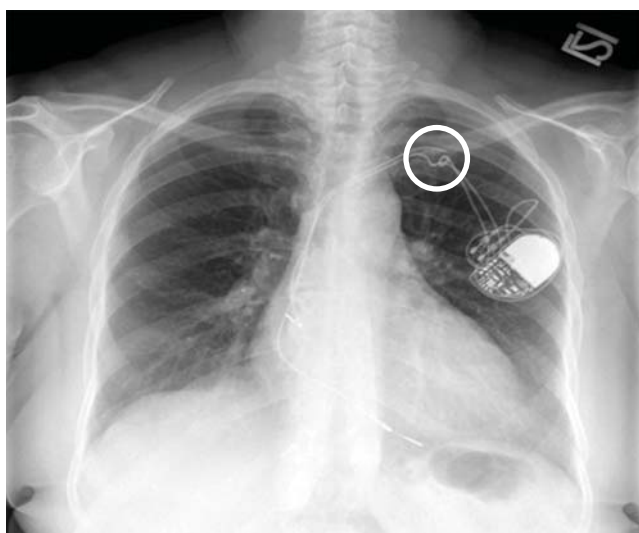


FIGURE 1. Posterior-anterior chest radiograph showed discontinuity of a lead wire, consistent with complete lead fracture.

A 69-YEAR-OLD WOMAN presented with fatigue, cough, and lightheadedness. She had a history of atrial fibrillation and complete heart block, for which she had a pacemaker (dual-pacing, dual-sensing, dual-response, and rate-adaptive mode) inserted in 2005. Her heart rate was 30 beats per minute.

A chest radiograph showed a fractured right ventricular pacemaker lead (**Figure 1**). Electrocardiography showed sinus rhythm with a high-grade atrioventricular block (**Figure 2**). Pacemaker interrogation confirmed the diagnosis of lead fracture. A new lead was placed, and the old lead was abandoned.

■ HOW LEADS BREAK

The rate of lead fracture ranges from 0.1% to

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4.2% per patient-year, and the annual failure rate increases progressively with time after implantation.^{1,2}

Extrinsic pressure on the lead can eventually break it. This can happen between the first rib and clavicle, in “subclavian crush” injury, or with any anatomical abnormality that narrows the thoracic outlet. Typically, classic subclavian crush results from entrapment of the pacemaker leads by the subclavius muscle or the costoclavicular ligament as the lead follows the needle course of the antecedent access puncture of the subclavian vein. This results in intermittent flexing of the lead and potential lead fracture³ and was likely the cause of lead fracture in our patient.

The risk of fracture is higher in patients under the age of 50, those who perform intense physical activity, women, and patients with greater left ventricular ejection fraction.^{4,5} Certain leads are prone to fracture due to design flaws. One of these was the Medtronic Sprint Fidelis cardioverter defibrillator lead, which was recalled in 2007.⁵

■ DETECTING LEAD FRACTURE

Symptoms of lead fracture vary, depending on the patient’s pacemaker-dependency and on the degree of loss of capture (ie, the degree to which the heart fails to respond to the pacemaker’s signals), and may include lightheadedness, syncope, and extracardiac stimulation.

The electrical integrity of a lead can be tested by measuring the circuit impedance, which normally ranges from 300 to 1,000 ohms.⁶ An insulation failure results in very low impedance, while a disrupted circuit due to lead fracture commonly causes a sudden

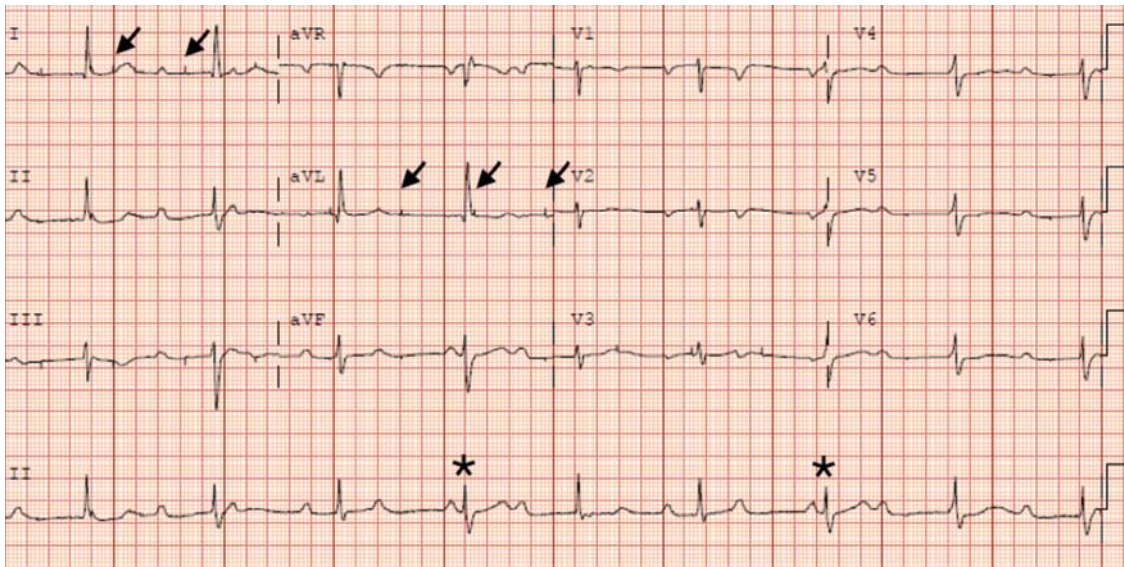


FIGURE 2. The patient's electrocardiogram showed sinus rhythm, high-grade atrioventricular block, reflected by the atrioventricular dissociation with intermittent conduction (asterisk), and pacemaker spikes (arrows) with loss of capture, reflected by the absence of QRS waves following the pacemaker spikes.

rather than gradual increase in impedance.⁶

Simple imaging studies such as chest radiography or fluoroscopy may establish the diagnosis of lead fracture. One should carefully trace every lead along its entire course and look for any conductor discontinuity, kinks, or sharp bends.⁶

■ REMOVE THE OLD LEAD, OR LEAVE IT IN PLACE?

The treatment for lead fracture is usually to put in a new lead, with or without extracting the old one.

In view of the potential complications of lead removal such as cardiac perforation or vascular tear, lead abandonment with placement of a new lead may be performed.⁷ There are no controlled clinical studies comparing

lead abandonment vs lead extraction.⁸ However, extraction is currently recommended only in patients in whom the old lead causes life-threatening arrhythmias, interferes with the operation of implanted cardiac devices, interferes with radiation therapy or needed surgery, or, due to its design or failure, poses an immediate threat to the patient if left in place.⁷ Lead removal is reasonable in patients who require specific imaging studies such as magnetic resonance imaging with no available imaging alternative for the diagnosis.⁷

In our patient, a new lead was placed without removing the fractured lead, with no complications. Afterward, the patient's heart rhythm was observed to be appropriately paced, and she was discharged home the following day. ■

The rate of lead fracture ranges from 0.1% to 4.2% per patient-year

■ REFERENCES

- Alt E, Völker R, Blömer H. Lead fracture in pacemaker patients. *Thorac Cardiovasc Surg* 1987; 35:101–104.
- Kleemann T, Becker T, Doenges K, et al. Annual rate of transvenous defibrillation lead defects in implantable cardioverter-defibrillators over a period of > 10 years. *Circulation* 2007; 115:2474–2480.
- Magney JE, Flynn DM, Parsons JA, et al. Anatomical mechanisms explaining damage to pacemaker leads, defibrillator leads, and failure of central venous catheters adjacent to the sternoclavicular joint. *Pacing Clin Electrophysiol* 1993; 16:445–457.
- Farwell D, Green MS, Lemery R, Gollob MH, Birnie DH. Accelerating risk of Fidelis lead fracture. *Heart Rhythm* 2008; 5:1375–1379.
- Morrison TB, Rea RF, Hodge DO, et al. Risk factors for implantable defibrillator lead fracture in a recalled and a nonrecalled lead. *J Cardiovasc Electrophysiol* 2010; 21:671–677.
- Swerdlow CD, Ellenbogen KA. Implantable cardioverter-defibrillator leads: design, diagnostics, and management. *Circulation* 2013; 128:2062–2071.
- Wilkoff BL, Love CJ, Byrd CL, et al; Heart Rhythm Society; American Heart Association. Transvenous lead extraction: Heart Rhythm Society expert consensus on facilities, training, indications, and patient management: this document was endorsed by the American Heart Association (AHA). *Heart Rhythm* 2009; 6:1085–1104.
- Maytin M, Epstein LM, Henrikson CA. Lead extraction is preferred for lead revisions and system upgrades: when less is more. *Circ Arrhythm Electrophysiol* 2010; 3:413–424.

ADDRESS: Muhammad Hammadah, MD, Department of Cardiology, Emory University School of Medicine, 1462 Clifton Road NE, Suite 507, Atlanta, GA 30322; mhamma2@emory.edu