

CASE REPORT

INTERMEDIATE

CLINICAL CASE

# Acute ST-Segment Elevation Myocardial Infarction as a Rare Postoperative Complication of Biventricular Implantable Cardioverter-Defibrillator Placement



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## ABSTRACT

We present a rare case of an 84-year-old woman who suffered an acute ST-segment elevation myocardial infarction as a postoperative complication of biventricular implantable cardioverter-defibrillator placement, caused by the left ventricular lead impinging onto the second obtuse marginal artery. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2022;4:1195-1199) Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

## HISTORY OF PRESENTATION

An 84-year-old White woman came to the hospital as an elective admission for implantable cardioverter defibrillator (ICD) placement. On presentation, her heart rate was 75 beats/min, respiratory rate was 16 breaths/min, blood pressure was 109/68 mm Hg, and oxygen saturation was 96% on room air. On physical examination, S1 and S2 were heard. No S3, S4, murmurs, rubs, or gallops were appreciated. The lungs were clear to auscultation bilaterally. No jugular venous distension or pedal edema was appreciated.

She successfully underwent a biventricular ICD placement with no intraoperative complications

(Medtronic lead, model number 479888, placed in the posterolateral cardiac vein). However, postoperatively, while in the postanesthesia care unit, the patient started to complain of a vague left-sided chest discomfort with nausea.

## PAST MEDICAL HISTORY

The patient's past medical history was notable for heart failure with reduced ejection fraction of 31%, atrial fibrillation with uncontrolled ventricular response, prior episodes of nonsustained ventricular tachycardia, hypertension, and coronary artery disease.

## LEARNING OBJECTIVE

- To recognize an acute myocardial infarction as a rare postoperative complication of biventricular ICD placement.

## DIFFERENTIAL DIAGNOSIS

The differential diagnosis included myocardial infarction, anxiety/panic attack, arrhythmias, and incision site pain.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

Manuscript received April 10, 2022; revised manuscript received June 8, 2022, accepted June 23, 2022.

## ABBREVIATIONS AND ACRONYMS

**CRT** = cardiac resynchronization therapy

**CS** = coronary sinus

**ICD** = implantable cardioverter defibrillator

**LV** = left ventricle

**OM2** = second obtuse marginal artery

## INVESTIGATIONS

Electrocardiogram showed ST-segment elevations in the lateral precordial leads along with reciprocal ST-segment depressions in V<sub>1</sub> through V<sub>4</sub> (Figure 1).

## MANAGEMENT

The patient underwent an emergent left heart catheterization, which showed a 100% distal occlusion of the second obtuse marginal artery (OM2) at the site, which corresponded to an anchoring mechanism of the left ventricular (LV) lead of the biventricular ICD (Figure 2). The lesion in the OM2 was negotiated with a coronary wire and a microcatheter. Without further intervention, an angiogram demonstrated restoration of flow distally (Figure 3). It was believed that there may have been a small thrombus that had resolved. Given the concern for potential injury to both the artery and the adjacent cardiac vein, balloon angioplasty was not performed initially. The patient's troponins continued to rise after the cardiac catheterization. She then underwent a hybrid procedure involving unscrewing of the LV lead along with a left heart catheterization. Angiography showed complete reocclusion of OM2 (Figure 4). Flow through the OM2 improved as the fixation mechanism on the LV lead was released and

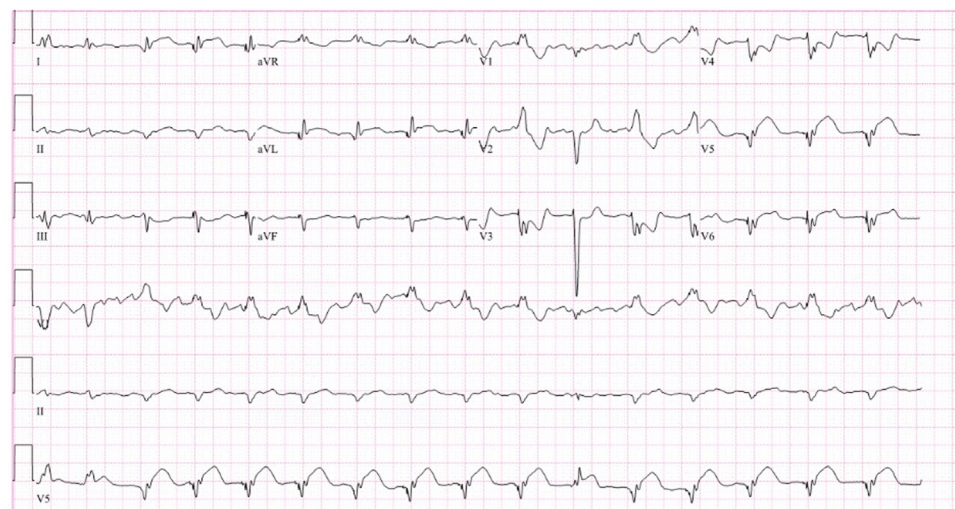
the lead was pulled back. An area of focal stenosis on OM2 was dilated at low pressures with a 2-mm balloon for a sustained period of time. A repeat angiogram done immediately postangioplasty showed no residual stenosis (Figure 5). The patient suffered no immediate complications postprocedure.

## DISCUSSION

Cardiac implantable electronic devices have come a long way from the first clinically successful cardiac pacemaker invented in 1960. The first implantations of an automatic internal defibrillator in humans began in 1980, followed by U.S. Food and Drug Administration approval in 1985, initially only for secondary prevention in survivors of cardiac arrest.<sup>1</sup> Implantable defibrillators were initially developed to prevent sudden cardiac death from ventricular arrhythmias; however, their scope has now expanded. Most ICDs now offer 3-tiered therapy for the termination of a programmed tachycardia: antitachycardia pacing, cardioversion, and defibrillation.

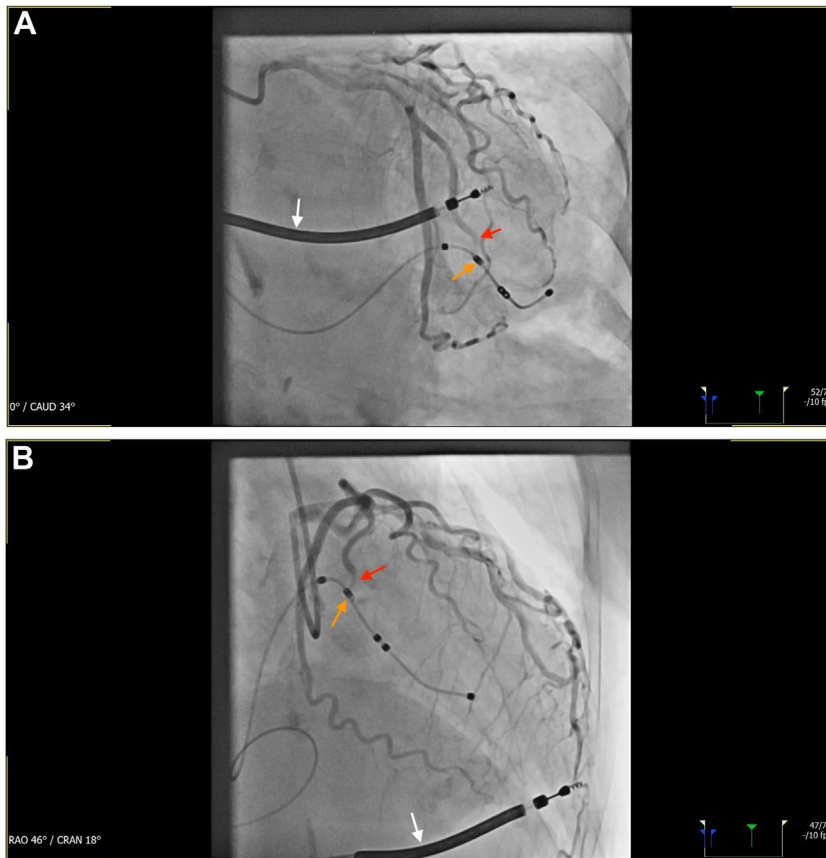
Building on the decreased mortality afforded by ICDs and pacemakers, cardiac resynchronization therapy (CRT) was developed. CRT is indicated in patients with an LV ejection fraction of <36%, sinus rhythm with left bundle branch block morphology, QRS interval duration more than 149 ms, and New York Heart Association functional class II, III, or IV

**FIGURE 1** Electrocardiogram Showing Acute ST-Segment Elevation Myocardial Infarction Post-Implantable Cardioverter-Defibrillator Placement



An electrocardiogram obtained for acute chest pain after placement of the implantable cardioverter-defibrillator showing ST-segment elevation in leads I, aVL, V<sub>5</sub>, and V<sub>6</sub>, with reciprocal ST-segment depressions in V<sub>1</sub> through V<sub>4</sub>.

**FIGURE 2** First Angiogram Showing Completely Occluded Second Obtuse Marginal Artery

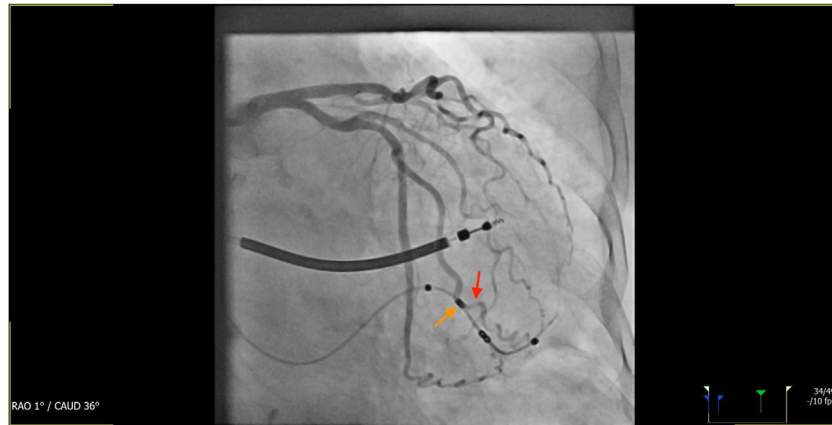


**(A)** Right anterior oblique caudal view. **(B)** Right anterior oblique cranial view. These images show the results of the first angiography after acute ST-segment elevation myocardial infarction post-implantable cardioverter-defibrillator placement in 2 different views. There is a 100% distal occlusion of the second obtuse marginal artery (**red arrows**), which corresponded to an anchoring mechanism of the left ventricle lead (**orange arrows**). The **white arrow** points to the right ventricular lead.

symptoms.<sup>2</sup> There was a Class IIa recommendation for ICD in our patient given the history of heart failure with a reduced ejection fraction of 31%, left bundle branch block with a QRS interval duration of 134 ms and New York Heart Association functional class III symptoms on optimal medical therapy. The ideal placement of the LV lead for CRT is technically demanding because of the high degree of variability in the anatomy of the coronary sinus (CS).<sup>3</sup> To achieve maximal hemodynamic benefit from CRT, appropriate positioning of the LV lead is essential in the region of viable myocardium that has delayed electrical activation and mechanical dyssynchrony.<sup>4</sup> The LV lead is usually implanted in the lateral and posterior branches of the CS, which can be variable in number, tortuosity, dimensions, and angulation.<sup>5</sup> Various techniques and adaptations have been used for successful LV lead placement.<sup>6</sup> The anchoring

mechanism of the LV lead in the CS can theoretically compress the adjacent coronary arteries, causing stasis and thrombosis. Endothelial injury to the coronary arteries can also be caused by traumatic and difficult placement of the LV lead. In our case, the etiology for the ST-segment elevation myocardial infarction was believed to likely be the anchoring mechanism of the LV lead compressing the adjacent OM2 or the invasion of the screw mechanism.

ICD placement carries an inevitable risk of complications. The majority of reported complications arose from lead displacement, hematoma, and pneumothorax.<sup>7,8</sup> However, to our knowledge, acute myocardial infarction has not been previously reported as a complication of ICD placement. Thus, this case highlights a rare complication of ICD LV lead placement.

**FIGURE 3** First Angiogram Showing Restoration of Flow in the Second Obtuse Marginal Artery

The results of the first coronary angiography after the second obtuse marginal artery lesion was negotiated with a coronary wire and a microcatheter. Without further intervention, an angiogram demonstrated restoration of flow distally in the obtuse marginal artery (**red arrow**). The **orange arrow** points to the left ventricle lead.

### FOLLOW-UP

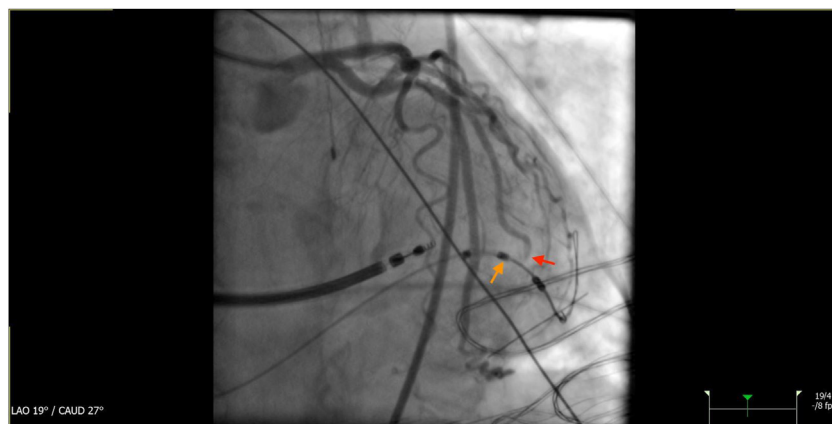
The patient tolerated the procedure well and was discharged home. She has been regularly following up with our cardiology clinic.

### CONCLUSIONS

Mechanical obstruction of a coronary artery is possible from the adjacent LV lead, leading to an

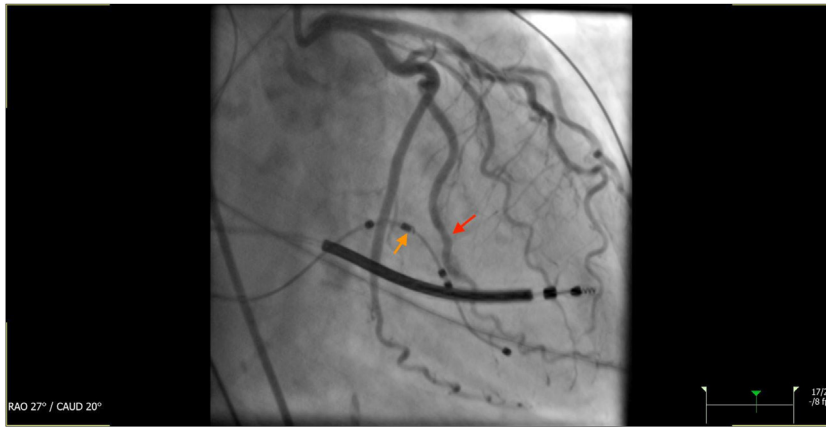
acute myocardial infarction. This rare complication has not been documented as a known complication of biventricular ICD placement. Awareness about this rare complication can lead to its earlier identification and, thus, an overall decreased morbidity and mortality.

**ACKNOWLEDGMENTS** The authors thank the patient for allowing us to participate in their care and the

**FIGURE 4** Second Angiogram Showing Completely Reoccluded Second Obtuse Marginal Artery

Second angiogram as a part of the hybrid procedure before the unscrewing of the left ventricle lead (**orange arrow**) showed a complete reocclusion of the second obtuse marginal artery (**red arrow**).

**FIGURE 5** Post-Hybrid Procedure Angiogram Showing No Residual Stenosis in the Second Obtuse Marginal Artery



Flow through the second obtuse marginal artery improved as the fixation mechanism on the left ventricle lead (**orange arrow**) was released and the lead was pulled back. An area of focal stenosis in the second obtuse marginal artery was dilated with a balloon. A repeat angiogram immediately postangioplasty showed no residual stenosis in the second obtuse marginal artery (**red arrow**).

staff at SUNY Upstate Medical University who contributed to the care of this patient.

#### FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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**KEY WORDS** cardiac resynchronization therapy, coronary angiography, electrocardiogram, myocardial infarction, postoperative