Inappropriate shock from delayed T-wave oversensing by a subcutaneous implantable cardioverter-defibrillator after septal myectomy for hypertrophic cardiomyopathy

Benjamin C. Salgado, MD,* Rita Coram, MD,* John Mandrola, MD,†
Rakesh Gopinathannair, MD, MA, FHRS*

*From the *Division of Cardiovascular Medicine, University of Louisville, Louisville, Kentucky, and †Baptist Medical Center, Louisville, Kentucky.*

Introduction

Subcutaneous implantable cardioverter-defibrillators (SICD) are effective for primary prevention in patients with hypertrophic cardiomyopathy (HCM), and proper screening can prevent oversensing despite significant left ventricular hypertrophy. Invasive treatment for HCM, however, may change the underlying substrate and impact appropriate SICD screening.

Case report

A 46-year-old man with midcavitary-type HCM underwent SICD (Emblem S-ICD model A209, Boston Scientific, Marlborough, MA) implantation on May 2016 for primary prevention of sudden cardiac death after event monitoring showed several episodes of nonsustained ventricular tachycardia and cardiac magnetic resonance demonstrated patchy late gadolinium enhancement noted in the basal anterior, basal anteroseptum, and left ventricular apex. The primary sensing configuration was used with SMARTPASS off. He continued to be symptomatic (frequent near-syncopal episodes and known hypotensive response with stress exercise) despite maximally tolerated medical therapy and underwent septal myectomy at another institution in June 2017. Preoperative electrocardiogram (ECG) showed sinus rhythm, left atrial enlargement, and left axis deviation with a QRS duration of 88 ms (Figure 1A). Postoperatively, he developed third-degree atrioventricular block, which required temporary pacing but which subsequently resolved. His recovery was otherwise uncomplicated. He did develop left bundle branch block (LBBB) following myectomy (Figure 1B). No changes were made in SICD sensing vector at discharge following myectomy. A follow-up ECG 39 days post-surgery showed persistent LBBB but taller T waves compared to the ECG obtained immediately postoperatively (Figure 2).

On October 2017, he presented to an outside hospital with complaints of irregular heartbeat and multiple ICD shocks. He reported missing a dose of metoprolol that day. Device interrogation showed sinus tachycardia and inappropriate shocks owing to T-wave oversensing (TWOS) (Figure 3). The device was updated with the new ECG template (SMARTPASS) and the sensing vector configuration was changed from primary to alternate. TWOS resolved and the patient has had no further recurrence since then.

KEY TEACHING POINTS

- Subcutaneous implantable cardioverter-defibrillators (SICDs) are effective for prevention of sudden cardiac death in patients with hypertrophic cardiomyopathy (HCM).
- New conduction abnormalities, especially left bundle branch block, may develop in HCM patients following septal reduction surgery and can result in T-wave oversensing (TWOS). Immediate interrogation of the SICD with update of templates following surgery is recommended.
- Close monitoring of SICD sensor settings for up to several months after invasive treatment for HCM is suggested to identify TWOS and avoid inappropriate shocks.

KEYWORDS Hypertrophic cardiomyopathy; Left bundle branch block; Septal myectomy; SICD; T-wave oversensing
(Heart Rhythm Case Reports 2018;4:408–411)

Dr Gopinathannair is a consultant for/received honoraria from St. Jude Medical, American Heart Association, Pfizer, Bristol Myers Squibb, and Zoll Medical, and is on the advisory board for HealthTrust PG. There are no conflicts of interest with respect to the content of the manuscript. All the other authors have no relevant conflicts of interest to disclose. **Address reprint requests and correspondence:** Dr Rakesh Gopinathannair, Division of Cardiovascular Medicine, University of Louisville, 550 So Jackson St, ACB/A3L41, Louisville, KY 40202. E-mail address: rakesh.gopinathannair@louisville.edu.

https://doi.org/10.1016/j.hrcr.2018.06.004

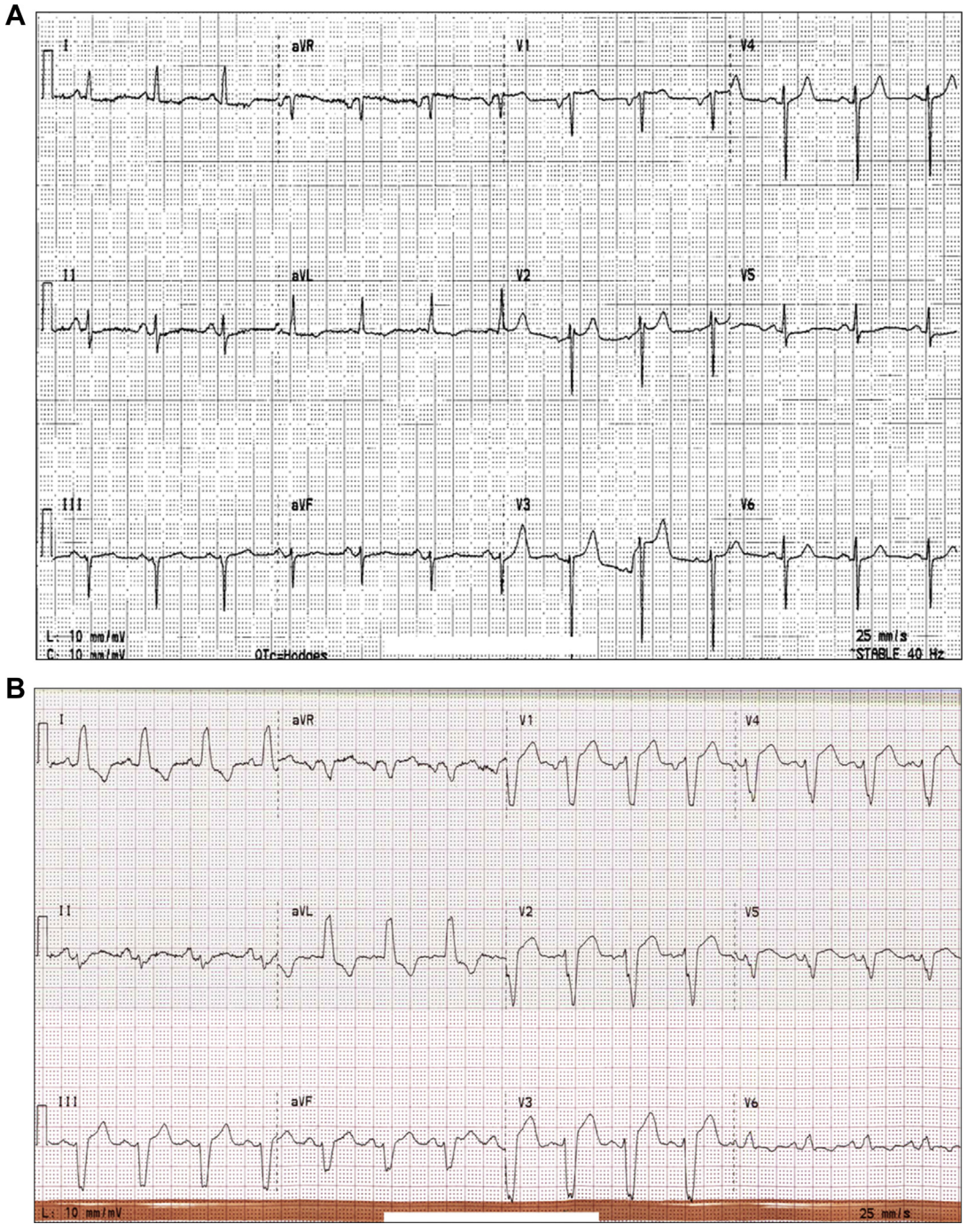

Figure 1 **A:** A 12-lead electrocardiogram prior to septal myectomy showing sinus rhythm, left atrial enlargement, and left axis deviation with a QRS duration of 88 ms. **B:** A 12-lead electrocardiogram soon after septal myectomy demonstrating normal sinus rhythm, new left bundle branch block, and a QRS duration of 160 ms.

Discussion

SICDs are effective in detecting and treating life-threatening ventricular arrhythmias.[1] SICD implantation avoids complications associated with intravascular lead placement, and can be used in eligible patients without pacing indications. Adequate ECG screening is important prior to implantation. The QRS-T wave morphology is used to identify if a patient is a candidate for an SICD and surface ECG is used as a substitute of subcutaneous ECG.[2] The SICD implant configuration allows 3 different vectors to sense: primary, secondary, and alternate. These vectors are screened using variations of ECG leads; positioning right arm lead in left sternal border at second costochondral joint, left arm lead in left sternal border at level of sixth costochondral joint, and finally positioning left leg lead in left anterior axillary line at level of sixth rib.[3] Patients are considered suitable if 1 or 2 sensing vectors are considered appropriate. Screening is successful in the majority of patients being evaluated for SICD. In a study performed on 96 patients