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An early repolarization pattern and L-IIB type of isolated single coronary artery anomaly in a patient who suffered sudden cardiac arrest: A fatal coexistence

Ahmet Güner, M.D. [a,*], Ezgi Gültekin Güner, M.D. [a], Ahmet Arif Yalçın, M.D. [a], Ali Kemal Kalkan, M.D. [a], Önder Turna, M.D. [b], Abdulkadir Uslu, M.D. [c]

[a] Department of Cardiology, Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital, Istanbul, Turkey
[b] Department of Radiology, Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital, Istanbul, Turkey
[c] Department of Cardiology, Kosuyolu Kartal Training and Research Hospital, Istanbul, Turkey

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ABSTRACT

The early repolarization pattern and single coronary artery (SCA) anomaly are rare causes of sudden cardiac arrest. The relationship between the early repolarization pattern and idiopathic ventricular fibrillation has previously been reported. Here, we describe a case of an early repolarization pattern and L-IIB type of isolated SCA anomaly in a patient who suffered a sudden cardiac arrest.

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Introduction

The early repolarization pattern (ERP) and single coronary artery (SCA) anomaly are rare causes of sudden cardiac arrest. The relationship between early repolarization and idiopathic ventricular fibrillation has previously been shown [1]. Moreover, coronary artery anomalies with inter-arterial course (between the pulmonary artery and aorta) pose the highest risk for sudden cardiac death (SCD). Here, we describe a case of an early repolarization pattern and L-IIB type of isolated SCA anomaly in a patient who suffered a sudden cardiac arrest.

Case report

A 34-year-old unconscious male patient was admitted to the emergency department. On arrival, his blood pressure was not measurable. The previous medical history of the patient was unremarkable and he did not participate in any competitive sport. According to the information obtained from his relatives, the patient lost consciousness while walking. He was intubated, his condition deteriorated rapidly and he suffered a cardiac arrest. Cardio pulmonary resuscitation (CPR) was initiated, and return of circulation was achieved after 5 cycles of CPR, with a blood pressure of 140/75 mmHg. In the emergency department, the patient's initial electrocardiogram (ECG) showed distinct terminal QRS notching, slurring in the inferior leads (Fig. 1) and there was no ischemic change such as ST segment elevation, T wave inversion or Q wave in the inferior leads. Bedside transthoracic echocardiography showed slight hypokinesis of the inferoposterior left ventricular wall. The patient then underwent diagnostic coronary angiography (CAG). Cannulation of the left main coronary artery using a Judkins Right-4 diagnostic catheter (Cordis Corporation, Miami Lakes, Florida, USA) revealed a SCA originating from the left sinus of the Valsalva, with branches to both right and left coronary systems, which was classified as type L-IIB (Lipton's) (Table 1). A 30% lesion was noted in the right coronary artery (RCA) (Fig. 2a). Contrast-enhanced cardiac computed tomography revealed that the RCA followed an anomalous course between the aorta and pulmonary artery (Fig. 2b) and confirmed the SCA originating from the left sinus of Valsalva (Fig. 2c and d). The patient was evaluated by cardiovascular surgeons and cardiologists and surgery was scheduled. The patient successfully underwent surgery and the RCA was revascularized with the right internal mammary artery. He was discharged uneventfully and did well during the 8 months of follow-up.

Discussion

The ERP is a common ECG variant manifested as end QRS notching or slurring together with the onset of the slur or peak of the notch ≥0.1 mV on the standard 12-lead ECG [2]. The prevalence ranges between 2.3% and 29.3% of the general population, depending on race, age and gender [3]. Although the ERP is usually considered as a benign ECG sign, previous studies have indicated that the ERP is associated with an increased

* Corresponding author at: Mehmet Akif Ersoy Thoracic and Cardiovascular Surgery Training and Research Hospital, Department of Cardiology, Kucukcekmece, 34303 Istanbul, Turkey.
E-mail address: ahmetguner488@gmail.com (A. Güner).

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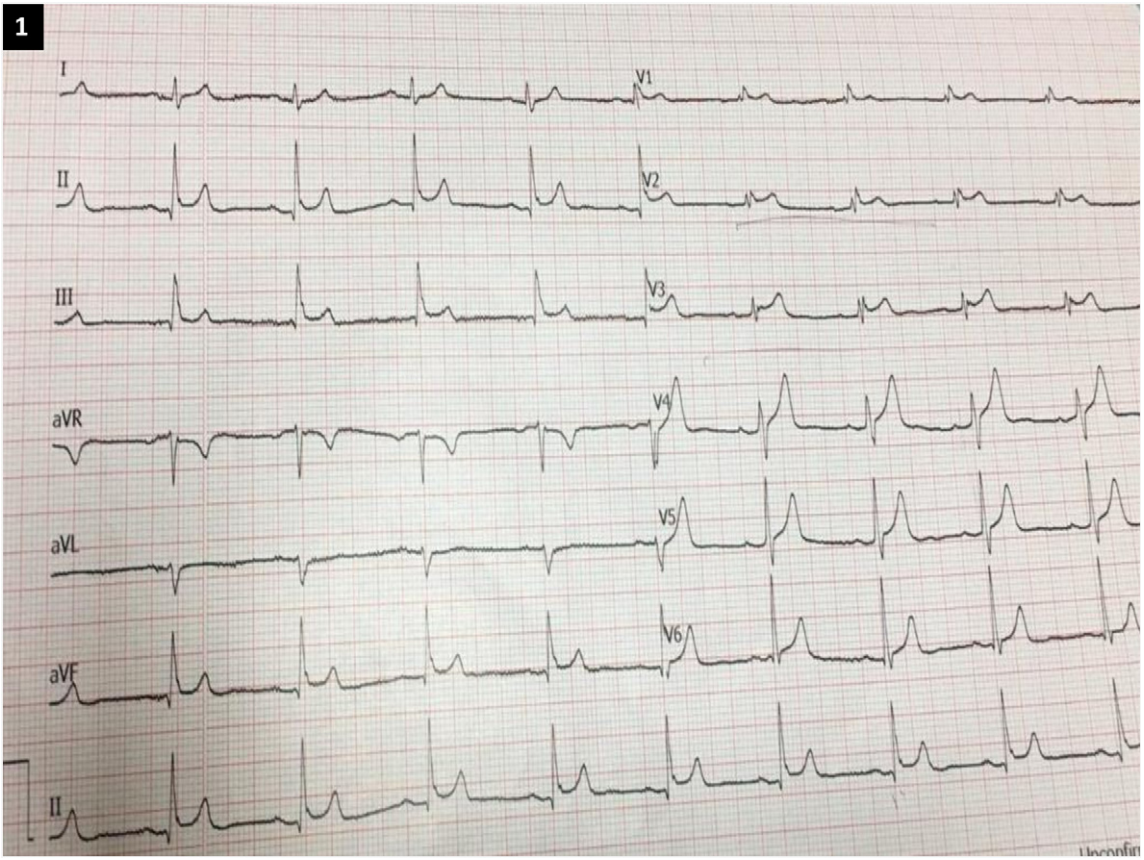

Fig. 1. Electrocardiography indicates distinct end QRS notching or slurring without any ischemic change in the inferior leads.

risk of ventricular arrhythmias (VAs) and SCD in the general population [1,4,5]. In particular, the ERP has been associated with a higher risk of ventricular fibrillation and sudden cardiac arrest [6]. Cheng et al. previously reported that early repolarization with J-point elevation in the inferior leads, end QRS notching and horizontal or descending ST segment, indicated a higher risk for VAs and SCD [5]. In addition, there is also some evidence regarding the prognostic significance of J wave morphology, as the presence of end QRS notching has been commonly observed in some idiopathic ventricular fibrillation patients, and in a meta-analysis, has been associated with significant risk of SCD [4]. The other clinical and ECG characteristics of a more malignant phenotype of the ERP are presented in Table 2. Furthermore, the ERP has been associated with structural heart disease including acute myocardial infarction and vasospastic angina [7]. On the basis of these findings, we suggest that the presence of end QRS notching or slurring in the inferior leads in the ECG of the patient may be associated with increased risk of sudden cardiac arrest, as described in our case. However, we are aware of the fact that its sensitivity and specificity to predict fatal arrhythmias are weak [8].

Most of the cases with SCA are asymptomatic and are usually detected incidentally during CAG. The prognosis of the cases varies according to the anatomical distribution of the anomaly. While some patients have excellent prognosis, angina pectoris, myocardial infarction, arrhythmia, syncope, SCD and heart failure may develop in some patients [9]. The presence of SCA may cause SCDs associated with exercise, especially in young people, and an existing atherosclerotic lesion may threaten a wider myocardial area than expected. Maron et al. indicated that 19% of sudden deaths in young athletes were found to be associated with a SCA which is reported as the second most common cause of SCD after hypertrophic cardiomyopathy in young athletes [10]. Especially in R II-III and L II type anomalies, the coronary artery branches can follow a fatal course between the aorta and the pulmonary artery and the dilated coronary artery is trapped between the aorta and the pulmonary artery during exercise [11]. As described in this case report, the type of SCA which originates from the left sinus of Valsalva and is located between the aorta and the pulmonary artery carries the highest risk for SCD [12]. To the best of our knowledge, coexistence of the ERP and L-IIB type of isolated SCA anomaly in a patient who experiences sudden cardiac arrest is the first to be reported in the current literature. In this case report, the most significant cause of sudden cardiac arrest is likely to be the presence of a SCA. However, ERP-related VAs and subsequent cardiac arrest is also a potential factor.

Table 1
Angiographic classification of a single coronary artery anomaly (Modified Lipton classification).

	Code	Definition
Localization of ostium	R	Right sinus of Valsalva
	L	Left sinus of Valsalva
Anatomical course of a single coronary artery	I	Normal anatomical course of single coronary artery and its branches
	II	Single coronary artery crosses the basal of the heart to give a contralateral coronary artery after separation from the right or left coronary sinus
	III	A single coronary artery originates from the right sinus, the left anterior descending artery and circumflex arteries, but not from a single root, separate from the a single coronary artery
Anatomical course of transverse branch	A	Front of great vessels (front of the right ventricle)
	B	Between aorta and pulmonary artery
	P	Behind the great vessels
	S	Septal type (from the interventricular septum)
	C	combined type

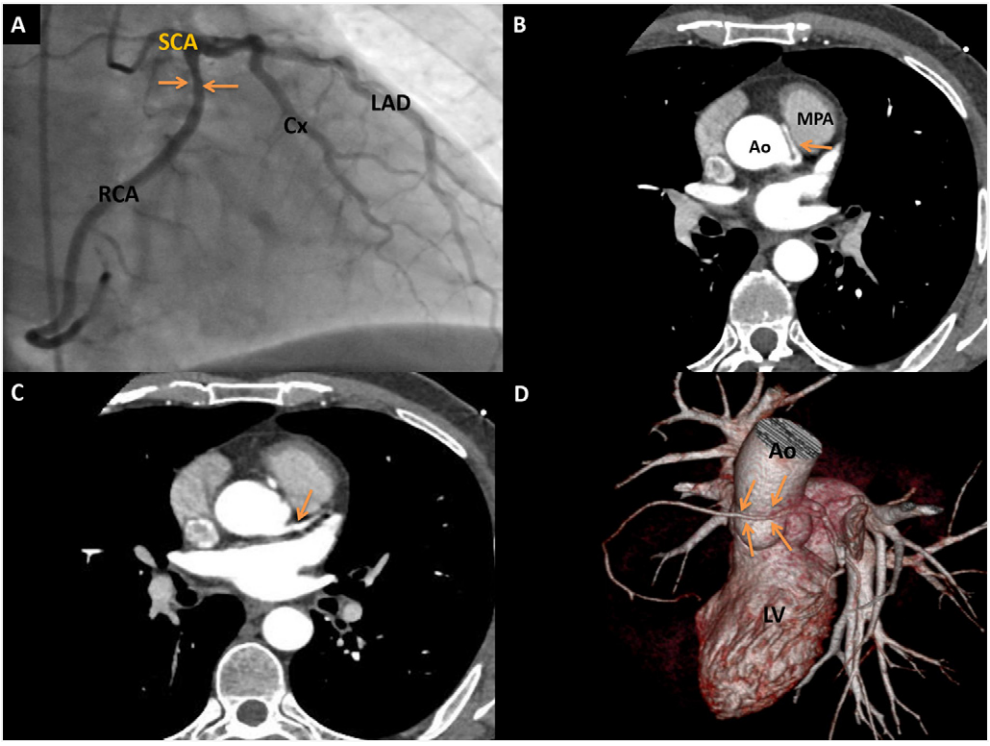

Fig. 2. Coronary angiography shows non-significant stenosis in the proximal part of right coronary artery (A) (yellow arrowheads). Contrast-enhanced cardiac computed tomography reveals that the right coronary artery is between the aorta and pulmonary artery (yellow arrowheads) and confirms the SCA originating from the left sinus of the Valsalva (yellow arrowhead) (B–D).

Table 2
Clinical and electrocardiographic risk factors for malignant arrhythmias associated with early repolarization.

Resuscitation from cardiac arrest
Documented ventricular fibrillation/tachycardia
Family history of sudden cardiac death
Presence of hereditary channelopathy (such as Brugada syndrome, Short QT syndrome)
Short coupled ventricular extrasystole
Transient augmentation of J waves
High amplitude J waves (>0.2 mV)
Wide spread J waves in infer or lateral leads
J waves without typical ascending ST segments
J waves in inferior leads
J waves in lateral leads
QRS notching or slurring in inferior leads

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Declaration of competing interest

The authors have no conflicts of interest to disclose.

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