Case Report

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Arrhythmogenic right ventricular cardiomyopathy mimicking Brugada – a case report

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Abstract

We report a rare case of arrhythmogenic right ventricular cardiomyopathy (ARVC). Middle-aged Kuwaiti gentleman presented to a polyclinic with complaints of dizziness and palpitation. Electrocardiogram (ECG) at the polyclinic showed polymorphic ventricular tachycardia, and hence he was referred to our center. ECG at the emergency room showed a Brugada pattern with epsilon waves. Echo showed right ventricular dysfunction with pulmonary arterial hypertension. Magnetic resonance imaging showed evidence of ARVC. He was referred to the electrophysiology team and implanted an implantable cardioverter-defibrillator electively.

Keywords: arrhythmogenic right ventricular cardiomyopathy, Brugada, pulmonary arterial hypertension, right ventricular dysfunction, ventricular tachycardia

Introduction and importance

Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a genetic condition characterized by the replacement of myocardial tissue by fibrofatty infiltration, most commonly affecting the right ventricle (RV). Phenotypic and clinical variation is wide, with most presenting in the late teens ranging from the presentation with ventricular arrhythmias and sudden death and heart failure to asymptomatic family members diagnosed during screening. A characteristic electrocardiographic finding in ARVC is symmetrical T wave inversion in the precordial leads and a so-called 'epsilon' wave in the terminal portion of the QRS segment thought to represent slowed intramyocardial conduction due to the replacement of actively conducting myocardial tissue and fibrofatty tissue[1].

At the molecular level, the structural changes typical of ARVC are a consequence of genetic mutations that result in defective intercellular adhesive proteins, typically desmosomes. Normally, these proteins together with gap junctions, form a coordinated protein network called a connexome that maintains cell adhesion, signal transfer, and electrical integrity. Loss of adhesion between cardiac myocytes leads to inflammation, fibrosis, apoptosis, and replacement with fibrofatty tissue[2]. The resultant disruption of electrical coupling is believed to provide the substrate for ventricular arrhythmia and myocardial dysfunction in ARVC. In contrast, in Brugada syndrome (BrS), the phenotypic features are thought to arise from disruption of a sodium conductance channel, SCN5A leading to the characteristic coved appearance of the ST segment in the electrocardiograph with ventricular arrhythmias arising as a consequence of transmural dispersion of repolarization and functional reentry. Phenotypic and molecular pathogenesis overlap between ARVC and BrS has been suggested as both conditions share pathological similarities in the context of abnormal connexome and structural cardiomyopathy[3,4]. We report an example of a patient with cardiac structural changes diagnostic of ARVC and an electrocardiogram (ECG) pattern resembling type 1 BrS.

HIGHLIGHTS

- Arrhythmogenic right ventricular cardiomyopathy (ARVC) is a primarily structural abnormality, and Brugada syndrome (BrS) is a genetic defect leading to characteristic electrical changes.
- Found to have pathophysiological similarity between ARVC and BrS.

Case presentation

A 61-year-old male presented with lightheadedness and syncope after an episode of self-terminating sustained ventricular tachycardia (VT). At the time of initial presentation, he was asymptomatic with an unremarkable physical examination: cardiac auscultation revealed normal first and second heart sounds with no additional heart sounds or murmurs and no evidence of congestive heart failure. He was taking no medications and denied any other medical history or family history suspicious of sudden cardiac death.

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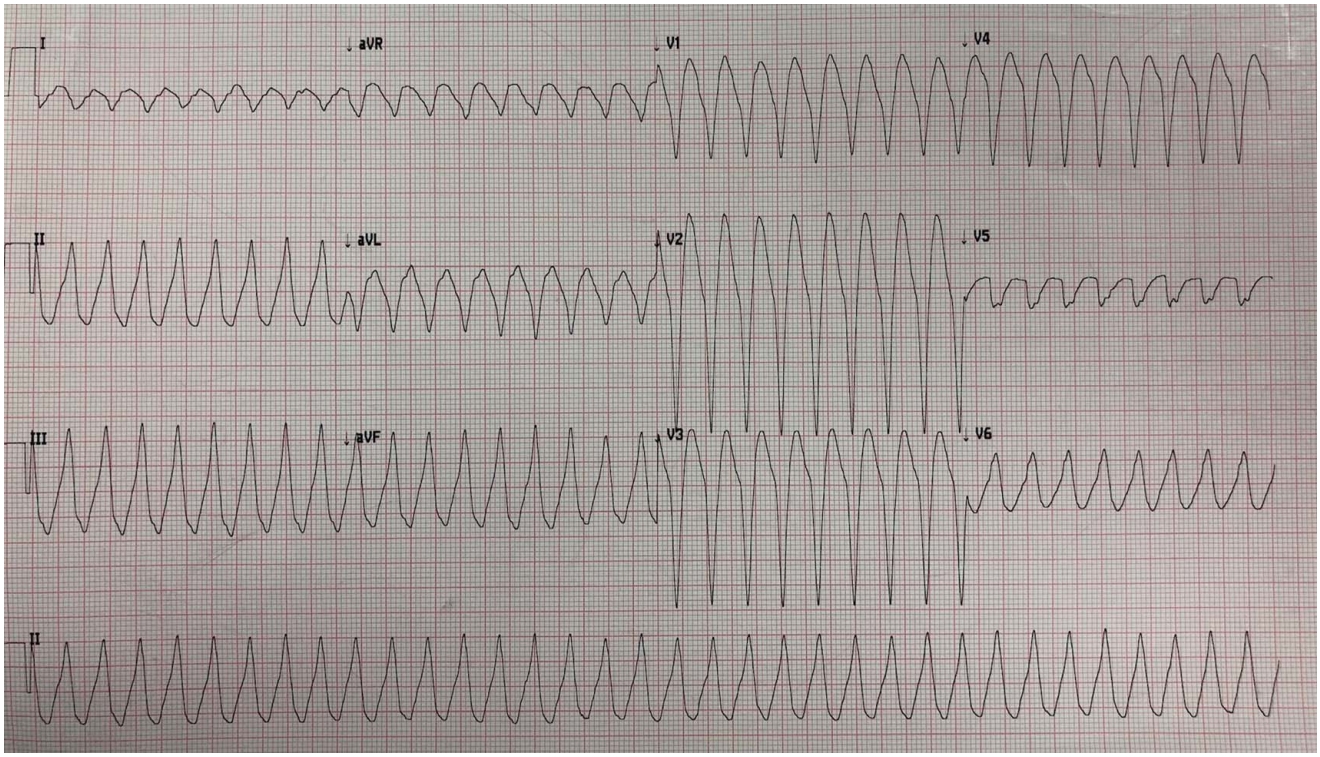

Figure 1. ECG shows VT , with an inferior axis leads and LBBB suggestive of a right ventricular outflow tract (RVOT) origin.

The presenting ECG confirmed VT at a rate of 209 beats/minute, with an inferior axis leads and LBBB (left bundle branch block) pattern in V_1 suggestive of a right ventricular outflow tract (RVOT) origin (Fig. 1). His ECG in sinus rhythm demonstrated a left axis and pronounced coving of the ST segment (J point > 3 mm) in $V_{1\&2}$ leads and T inversion in V_{1-3} leads and a possible epsilon waves in V_2 (Fig. 2); a pattern similar to BrS type 1. A transthoracic *echocardiography* study revealed normal left ventricular (LV) size and systolic function, no LV wall motion abnormalities, and a dilated RV (base 4.7, mid 4.6, longitudinal 8.3 cm) with markedly impaired systolic function [RVOT (parasternal short axis) in PSAX 3.9 and PLAX (parasternal long axis) 4.7]. Also noted were borderline RV systolic pressure and moderate to severe tricuspid regurgitation (effective regurgitant orifice area 0.5 cm^2, regurgitant volume 52 ml, jet/right atrial ratio 42%, and no systolic flow reversal in hepatic veins). A subsequent *cardiac MRI* (1.5-Tesla; GE Optima) confirmed a markedly dilated RV; RV end-diastolic volume was 154 ml/m^2 and RV end-diastolic volume:LV end-diastolic volume = 2:1), thinned RV free wall with akinesic and dyskinetic segments and microaneurysms. RV systolic function was impaired (ejection fraction = 27%). T1-weighted images demonstrated fatty

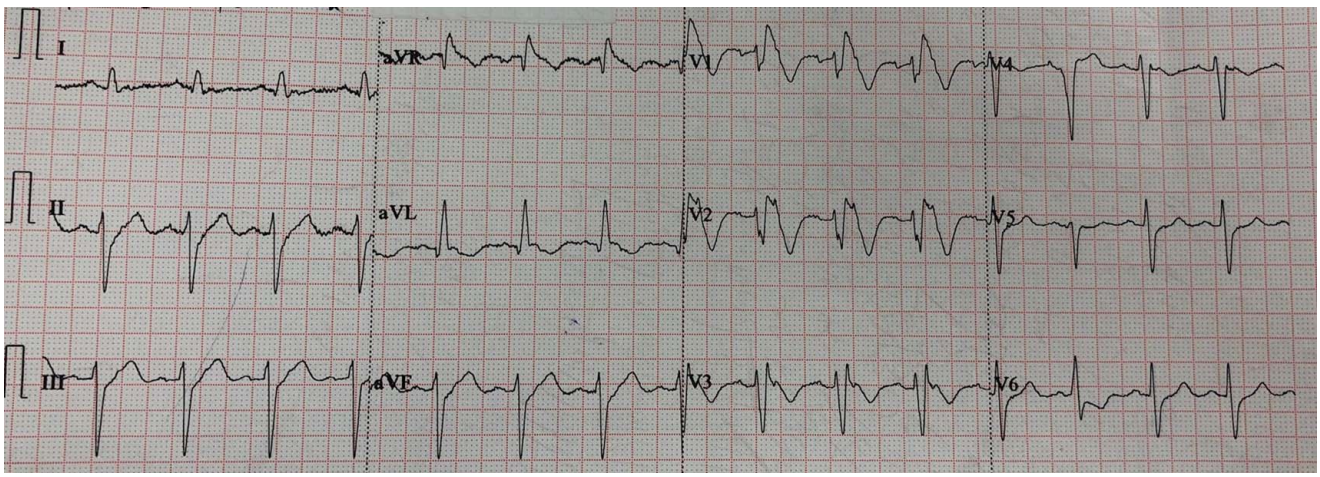

Figure 2. ECG in sinus rhythm demonstrated a left axis and pronounced coving of the ST segment in V1&2 leads and T inversion in V1–3 leads and a possible epsilon waves in V2.

infiltration in the apical free wall and apical septum (Fig. 3), and transmural late gadolinium enhancement demonstrated faint enhancement of the RV free wall and linear enhancement of the mid septum, lateral LV wall, and RV insertion points (Fig. 4).

Based on these findings, a definite ARVC diagnosis, according to the 2010 revised Task Force Criteria[5]. was made. An implantable cardioverter-defibrillator was placed, and he was prescribed oral bisoprolol. The patient had no history of fever or exposure to sodium channel blockers and tricyclic antidepressants. The work has been reported in line with the SCARE (Surgical CAse REport) 2020 criteria[6].

Clinical discussion

The 12-lead ECG is an important diagnostic tool to distinguish ARVC from other cardiac conditions. Thus, one important aspect of our case is the similarity of the baseline ECG in our patient to the ECG characteristic of BrS.

Although ARVC is a primarily structural abnormality and BrS is a genetic defect leading to characteristic electrical changes, there is an increasing body of data suggesting a pathophysiological similarity between ARVC and BrS[7]. ECG criteria considered consistent with ARVC have been summarized in the revised task force[5]; however, there is a phenotypic overlap between ARVC and BrS. Although an epsilon wave is uncommon in BrS, other conduction abnormalities appear to be more common such as terminal activation delay greater than 55 ms, T wave inversions in the right precordial leads, and fragmented QRS[8]. Late potentials on signal-averaged ECG have also been reported commonly in BrS patients[9]. Monomorphic VTs are considered rare in BrS patients but have been described in case reports and other studies[10].

Cardiac magnetic resonance studies in BrS patients have revealed, in some cases, structural features similar to ARVC. These include dilation of the RVOT, and high intramyocardial T1-weighted signal suggestive of fatty infiltration and RV wall motion abnormalities[11]. Histopathologic findings of mixed phenotypes suggested that the Brugada-like ECG findings and arrhythmias observed in some ARVC patients are due to structural epicardial–endocardial heterogeneity of repolarization in the RV wall, which may cause an ST-segment elevation resulting from the voltage gradient created and electrical mechanisms similar to those responsible for repolarization changes of BrS, and subsequent arrhythmias due to local reentry circuits. Most recently, a pathophysiological link between ARVC and BrS has been suggested based on clear molecular and cellular interdependence between desmosomes and SCN5a sodium channel and the intercalated discs that could be the pathophysiological link between these two conditions[12].

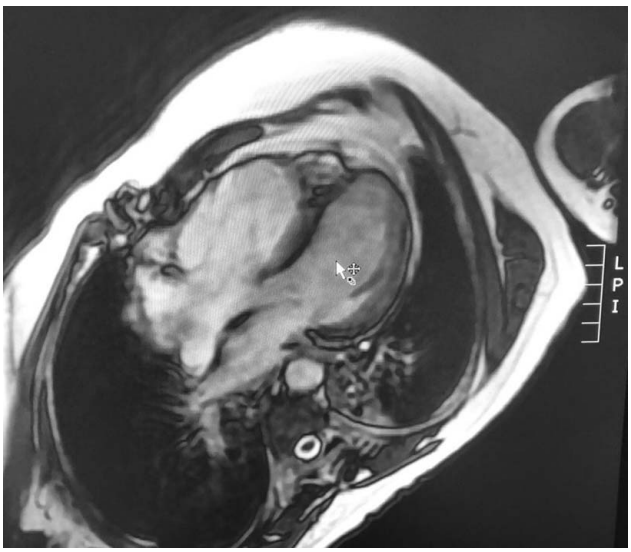

Figure 3. T1-weighted images demonstrated fatty infiltration in the apical free wall and apical septum.

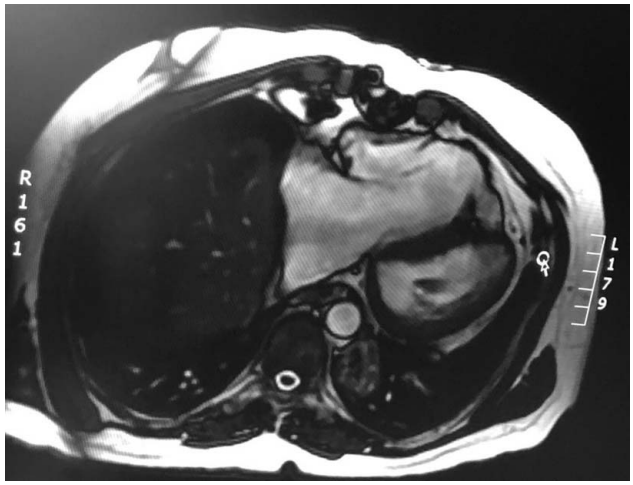

Figure 4. Transmural late gadolinium enhancement demonstrated faint enhancement of the RV free wall and linear enhancement of the mid septum, lateral LV wall, and RV insertion points.

Conclusion

Although a genetically diverse considerable phenotypic overlap between ARVC and BrS is recognized, perhaps sharing pathogenic mechanism at the molecular level underscores the importance of sodium conductance via the SCN5A channel in structural cardiac disorders.

Ethical approval

This is a case report.

Consent

Written informed consent was obtained from the patient for the publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Author contribution

M.A.J and H.R.: participated in data acquisition, analysis, and manuscript preparation; M.L.L.: participated in the data analysis; B.T. and R.D.: participated in the data analysis and drafting of the manuscript. M.A.J., P.A.B., and R.R.: participated in analysis and manuscript preparation. All authors had access to data and take responsibility for the integrity of data and the accuracy of data analysis. All authors have read and approved the manuscript.

Conflicts of interest disclosure

The authors declare that they have no conflicts of interest.

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Will register shortly.

Guarantor

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Data availability statement

There are no ethics restrictions preventing the sharing of the raw data.

Provenance and peer review

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Limitations

We lost follow-up of this patient.

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