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Professional paper

Brugada Syndrome and Right Ventricle Morphofunctional Abnormalities on Echocardiography in Young Male with Family Anamnesis of Sudden Cardiac Death

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A B S T R A C T

First presented by Brugada and Brugada in 1992, Brugada Syndrome (BrS) is a primary electrical disease of the heart that causes sudden cardiac death or life-threatening ventricular arrhythmias. This disease is hereditary autosomic dominant transmitted and genetically determined. The syndrome has been linked to mutations in SCN5A, the gene encoding for the α-subunit of the sodium channel. Electrocardiogram (ECG) abnormalities indicating Brugada syndrome, include repolarization and depolarization abnormalities in the absence of identifiable structural cardiac abnormalities or other conditions or agents known to lead to ST-segment elevation in the right precordial leads (V1-V3). Intravenous administration of sodium channel blocking drugs may modify the ECG pattern. Ajmaline, flecainide, procainamide and propafenone exaggerate the ST-segment elevation or unmask it when it is initially absent. An implantable cardioverter-defibrillator (ICD) is the only proven effective device treatment for the disease. Although BrS is primary electrical disease, some authors have suggested the presence of morphological and functional abnormalities mainly located in the right ventricle (RV), notably in the outflow tract (RVOT). In this short report we will present a young male, with predisposition and positive family history of sudden cardiac death, with complete diagnostic procedure including propafenon testing unmasking Brugada syndrome. An echosonography revealed dilated apical right ventricle, suggesting BrS is not only electrical disorder, but may include morphofunctional abnormalities, described in previous reports. In addition, we reviewed the possible connection between Brugada syndrome and morphological abnormalities in RV.

Key words: *Brugada syndrome, sudden cardiac death, electrical disorder, sodium chanel blocking agents, inheritance, propafenon test, morphological abnormalities in RV, implantable cardioverter defibrillator, arrhytmogenic right ventricular cardiomyopathy, ST-segment elevation in the right precordial leads*

Introduction

Since its initial discovery in 1992, the Brugada syndrome (BrS) has instigated many studies, due to high risk of sudden death, especially in the young and otherwise healthy people[1]. The Brugada syndrome is characterized by an ST segment elevation in the right precordial leads and a high incidence of sudden death in patients with structurally normal heart[2]. There are three type's of Brugada ECG patterns of which only type 1 is diagnostic of the Brugada syndrome[3]. Type one is characterized by a coved ST-segment elevation =2 mm (0.2 mV) followed by a negative T wave in more than one right precordial leads (V1-V3) in the presence or absence of sodium channel-blocking agent. Type two is characterized by a saddleback ST-segment elevation with a high takeoff ST elevation of =2 mm or through displaying =1 mm ST elevation, and either positive or biphasic T wave. Type three has either a saddleback or coved appearance with an ST-segment elevation of <1 mm[2-3].

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Inheritance of Brugada syndrome occurs via an autosomal dominant mode of transmission. Gene linked to Brugada syndrome is SCN5A, that encodes for the alpha subunit of the cardiac sodium channel gene[2,4]. For many years BrS has been considered a purely electrical disease, although recently, some authors have suggested the presence of morphological abnormalities leading to functional abnormalities in patients with BrS, predominately located in the right ventricle (RV) and especially in the outflow tract (RVOT)[5,6]. The benefit of cardiac magnetic resonance imaging (CMRI) was also examined in some studies, concluding as well, that CMRI detects a high prevalence of mild structural changes of the RV in patients with BrS, suggesting structural patophysiology in BrS[7]. Morphofunctional abnormalities such as dilatation and dysfunction of RV on echocardiography were also reported[8,9], as well as atrophy or fatty replacement of the RV in 20% of patients with BrS by Papavassiliu et al[10].

Right ventricular morphological and functional abnormalities, such as global dilatation, aneurysm and wall motion abnormalities, due to fat replacement of myocardial tissue, are characteristically displayed in arrhytmogenic right ventricular cardiomyopathy (ARVC)[11].

In contrast to BrS, ventricular arrhythmias in ARVC are most commonly monomorphic VTs, often precipitated by catecholamines, or exercise, whereas in BrS arrhythmias and typical ECG pattern are enhanced by vagotonic agents or beta adrenergic blockers, and ventricular arrhythmias are most often polymorphic and commonly occur at sleep or rest[11,12]. BrS and ARVC are two distinct clinical entities, regarding both, clinical presentation and genetic predisposition[13]. Nevertheless, new findings suggest the presence of morphological abnormalities in the patients with BrS[5–9].

Case report

A 48-year old man was administrated to our clinic for regular examination. His medical history revealed only hyperlipidemia treated by dietary measures, while no history of tobacco, drugs or alcohol abuse was present. He did not have any specific symptoms and tolerated well moderate physical activities. When asked about sudden cardiac death in young relatives, he reported that one brother, in the age of 42, and other brother in the age of 31 died suddenly, and the third brother, living abroad, has an implanted cardioverter defibrillator (ICD), but he didn't know why. On examination, his vital signs were normal. His 12-lead ECG pattern showed an rsR' pattern in V1 and rSr' pattern in V2, consistent with incomplete right bundle branch block with QRSD of 113 ms, and left anterior hemiblock (LAH) (Figure 1). Interestingly, during monitoring in coronary care unit his ECG spontaneously showed intermittent ST segment elevation in leads V2-V3 characteristic for patients with BrS[2,13].

A transthoracic echocardiogram was also performed, which demonstrated a structurally normal left ventricle with normal systolic and diastolic function. One pathological feature that was found was an aneurismatic dilatation of an apical part of right ventricle (Figure 4). He had mild aortic regurgitation, and mild pulmonary regurgitation.

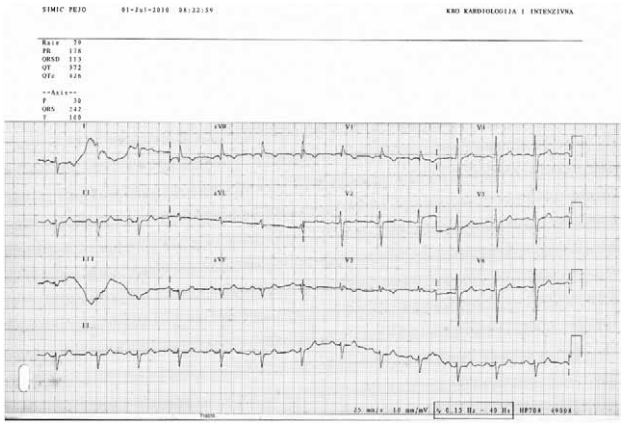

Fig. 1. On admittion ECG pattern revealed rsR' pattern in V1 and rSr' pattern in V2, consistent with incomplete right bandle branch block and left anterior hemiblock (LAH).

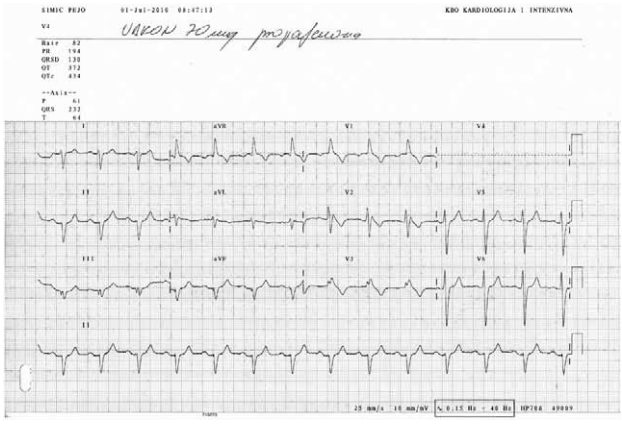

Fig. 2. After 70 mg of Propafenon, prolongation of QRS distance was noted from 113 to 130 ms, and elevation of an ST segment from V1 to V3 leades.

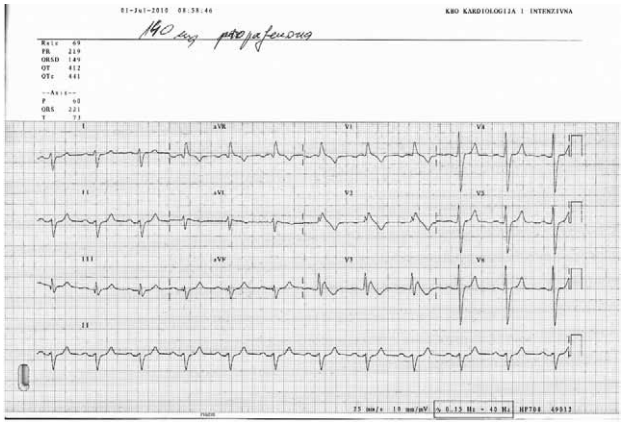

Fig. 3. After additional 140 mg of Propafenone further prolongation of QRS distance to 149 ms was noted with significantly higher ST segment elevation from V1-V3 leads.

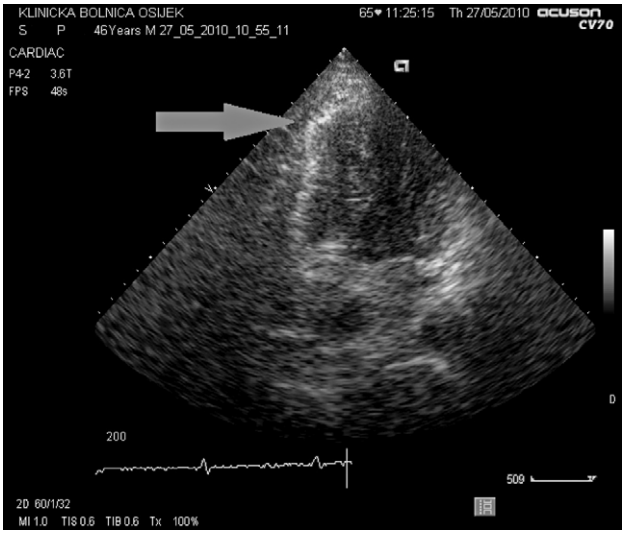

Fig. 4. A transthoracic echocardiogram showed an aneurismatic dilatation of an apical part of right ventricle.

Patient was submitted to treadmill test by Bruce protocol, which he completed by achieving targeted heart rate (158/min) after 13 minutes of testing (fifth stage, 250 W). During test he had no chest pain, his ECG pattern showed no arrhythmias or ST segment changes.

In addition, cardiac catheterization revealed no significant obstructive coronary artery disease; visual estimation showed only luminal irregularities of circumflex coronary artery, nonsignificant stenosis of mid right coronary artery (40%) of the ostium of the ramus intermedius (50%).

Cardiac magnetic resonance imaging (CMRI) revealed normal contractile function of the heart, with slightly marked component of transversal diameter of both left and right atrium, suggesting discrete enlargement.

During monitoring in coronary care unit Propafenon test was performed. We started by administrating Propafenon at dosage of 2 mg/kg/TT. After administration of 70 mg of Propafenon, prolongation of QRS distance was noted from 113 to 130 ms, and elevation of an ST segment from V1 to V3 leads (Figure 2). Further, we additionally administrated 140 mg of Propafenone, which was followed by further prolongation of QRS distance to 149 ms (Figure 3) and significantly higher ST segment elevation from V1-V3 leads. After 5 minutes of monitoring, regression of QRS distance was recorded with normalization of ST segment on leads V2-V3. This was consistent with positive Propafenon testing which confirmed diagnosis of Brugada syndrome, by unmasking ECG pattern to type I. On 21 July 2010 he was implanted cardioverter defibrillator (ICD). The ICD was tested during implantation and functioned properly. His sons were advised to undergo screening.

Discussion

The prevalence of the Brugada syndrome in the general population is difficult to determine as persons with Brugada syndrome usually do not have symptoms and their first presentation can be sudden death[14,15].

It is sometimes difficult to diagnose and make risk stratification for patients with BrS.

On the other hand, a sudden cardiac death due to physical exercise in young athletes in Croatia suffered of arrhythmogenic right ventricular dysplasia reached 0.07/100 000 yearly, in all young athletes suffered of heart diseases reached 0.19/100 000 yearly, and in the total male population aged 15–40 engaged in sports and recreational physical exercise: 0.71/100 000 yearly[16–20].

In our case, a patient had the electrocardiographic anomalies when we administrated Propafenone. Drugs usually used to unmask BrS, are sodium channel blocking drugs Ajmaline, Flecainide, Procainamide, Pilsicainide and Propafenone[2,20,21].

Positive Propafenon test and positive family history of sudden cardiac death of two brothers, were sufficient to implant profilactically ICD. The Report of the Second Consensus Conference on Brugada Syndrome, published in 2005, stated that for asymptomatic patients with family history of sudden cardiac death suspected to be due to BrS, implantation of ICD is a class IIa recommendation[2].

Finding of an aneurismatic dilatation of an apical part of right ventricle on echocardiography supports latest concept that relevant percentage of BrS patients have RV morphofunctional abnormalities. Despite the original concept that BrS exclude structural abnormalities of the heart it is clear that further studies on this subject are needed.

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BRUGADA SYNDROM I MORFOLOŠKE I FUNKCIONALNE ABNORMALNOSTI DESNOG VENTRIKULA U MLADOG MUŠKARCA SA OBITELJSKOM ANAMNEZOM NAGLE SRČANE SMRTI

S A Ž E T A K

Prvi puta objavljen od strane autora Brugada i Brugada 1992 godine, Brugada Sindrom (BrS) je primarno električni poremećaj srca, koji može uzrokovati naglu srčanu smrt ili maligne poremećaje srčanog ritma. Bolest je nasljedna, a prenosi se autosomno dominantno i genetski je određena. Iako je velik broj gena analiziran, sindrom je sa sigurnošću povezan sa mutacijama u genu SCN5A, gen koji kodira α-podjedinicu natrijevih kanala. ECG promjene koje indiciraju Brugada sindrom, ukljlučuju repolarizacijske i depolarizacijske promjene u odsutnosti strukturne bolesti srca ili drugih stanja ili lijekova za koje je poznato da mogu dovesti do elevacije ST-segmenta u desnim prekordijalnim odvodima (V1-V3). Intravenska primjena blokatora natrijevih kanala, mogu izmjeniti izgleg EKG-a. Ajmalin, flekainid, prokainamid i propafenom pojačavaju elevaciju ST-segmenta ili ju demaskiraju ako je inicijalno skrivena. Implantibilni kardioverter defibrilator (ICD) jedino je dokazano učinkovito liječenje ove bolesti. Iako je BrS primarno električka bolest, neki su autori predložili mogućnost prisutstva morfoloških i funkcionalnih abnormalnosti uglavnom smještenih u desnom ventrikulu (DV), najčešće u izgonskom traktu DV. U ovom kratkom članku prikazat ćemo slučaj mladog muškarca, sa predispozicijom i pozitivnom obiteljskom anamnezom nagle srčane smrti. Bolesniku je učinjena kompletna dijagnostička obrada, te je učinjen Propafenonski test, koji je bio pozitivan, te otkrio EKG promjene karakteristične za BrS. Ehokardiografski pregled je pokazao dilatiran apikalni segment DV, što je sugeriralo da BrS nije samo električki poremećaj srca, nego možda uključuje i morfofunkcionalne abnormalnosti, što je i opisivano u literaturi. U konačnici, razmotrili smo mogućnost povezanosti Brugada sindroma i morfoloških abnormalnosti DV.