CASE REPORT

Coexistence of Brugada and Wolff Parkinson White syndromes: A case report and review of the literature

Brugada ve Wolff Parkinson White sendromu birlikteliği: Olgu sunumu ve literatür derlemesi

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Summary– A 31-year-old male patient presented with complaints of palpitations, dizziness, and recurrent episodes of syncope. A 12-lead electrocardiogram (ECG) revealed manifest ventricular preexcitation, which suggested Wolff Parkinson White syndrome. In addition, an incomplete right bundle branch block and a 3-mm ST segment elevation ending with inverted T-waves in V2 were consistent with coved-type (type 1) Brugada pattern. An electrophysiological study was performed, and during the mapping, the earliest ventricular activation with the shortest A-V interval was found on the mitral annulus posterolateral site. After successful radiofrequency catheter ablation of the accessory pathway, the Brugada pattern on the ECG changed, which prompted an ajmaline provocation test. A type 1 Brugada ECG pattern occurred following the administration of ajmaline. Considering the probable symptom combinations of these 2 coexisting syndromes and the presence of recurrent episodes of syncope, programmed ventricular stimulation was performed and subsequently, ventricular fibrillation was induced. An implantable cardioverter-defibrillator was implanted soon after.

Özet– Otuz bir yaşında erkek hastada çarpıntı, baş dönmesi ve tekrarlayan senkop atakları şikayeti mevcut idi. 12 derivasyonlu elektrokardiyogramda (EKG) Wolff Parkinson White (WPW) sendromunu destekleyen açık ventriküler preeksitasyon vardı. Ayrıca, inkomplet sağ dal bloğu ve V2 derivasyonunda 3-mm ST-segment yükselmesi ve ters dönmüş T dalgası coved-tip (Tip-1) Brugada paterni ile uyumlu idi. Hastaya elektrofizyolojik çalışma (EFÇ) yapıldı ve haritalama esnasında, en erken ventriküler aktivasyonun ve en kısa AV intervalin mitral anulus posterolateral lokalizyonda olduğu saptandı. Aksesuar yolun başarılı radyofrekans ablasyonundan (RF) sonra Brugada EKG paterninin değişkenlik göstermesi üzerine ajmalin provakasyon testi yapıldı. Ajmalin provakasyon testi sonrası tip-1 Brugada EKG paterni gelişti. Hastamızda tekrarlayan senkop ataklarını ve bu iki sendromun semptom birlikteliğini dikkate alarak, programlı ventriküler stimülasyon uyguladık ve ardından ventrikül fibrilasyonu uyarıldı ve sonucunda implante edilebilir kardiyoverter defibrilatör yerleştirildi.

Brugada syndrome (BrS) is an autosomal dominant genetic disorder with specific electrocardiographic characteristics on precordial leads and the absence of structural heart disease, ischemia, and electrolyte disturbances.[1] Ventricular arrhythmia (VA) causing sudden nocturnal death can occur in patients with BrS.[2] It has been reported that the arrhythmogenic substrate in BrS is not limited to the ventricles, and supraventricular arrhythmias may also occur in these patients.[3]

Wolff Parkinson White (WPW) syndrome is the most common cause of ventricular preexcitation. As it usually presents with supraventricular tachycardia, sudden cardiac death (SCD) may also occur in rare cases.[4] The coexistence of Brs and WPW is rare, with

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a probability of 1 per million people. Given the common symptoms of these 2 syndromes and the variable electrocardiogram (ECG) pattern of BrS, the coexistence of these entities can create difficulties in patient management.

Presently described is the case of a patient who was diagnosed with WPW syndrome and coexisting Brugada syndrome, with electrocardiographic features that changed before and after radiofrequency (RF) ablation of the accessory pathway (AP).

CASE REPORT

A 31-year-old male patient presented at the outpatient cardiology clinic with complaints of palpitations, dizziness, and recurrent episodes of syncope. A baseline 12-lead ECG demonstrated normal sinus rhythm with evidence of manifest ventricular preexcitation (WPW syndrome). The sum of delta wave polarities in the inferior leads was negative (negative in lead II, isoelectric in lead III, and negative in lead aVF), and the QRS transition was between leads V1 and V2. The ECG findings suggested a left posterior AP.[5] An incomplete right bundle branch block and a 3-mm ST segment elevation ending with inverted T-waves in derivation V2 were also noted and found to be consistent with a coved-type (type 1) Brugada pattern (Fig. 1). The patient had no family history of SCD. His physical examination was normal, as were serum electrolyte levels and other biochemical and hematological parameters. He denied any intake of medications that might cause a Brugada pattern on the ECG. Transthoracic echocardiographic examination did not reveal any structural heart disease.

Abbreviations:

AF	*Atrial fibrillation*
AP	*Accessory pathway*
AP-ERP	*Antegrade effective refractory period of the accessory pathway*
BrS	*Brugada syndrome*
CS	*Coronary sinus*
ECG	*Electrocardiogram*
EPS	*Electrophysiological study*
HRA	*High right atrium*
ICD	*Implantable cardioverter-defibrillator device*
PVS	*Programmed ventricular stimulation*
RF	*Radiofrequency*
RVOT	*Right ventricular outflow tract*
SCD	*Sudden cardiac death*
VA	*Ventricular arrhythmia*
VF	*Ventricular fibrillation*
WPW	*Wolff Parkinson White syndrome*

After obtaining informed consent, an electrophysiological study (EPS) was performed. Multipolar diagnostic catheters were placed in the high right atrium (HRA) and coronary sinus (CS). Programmed electrical stimulations and burst pacings from both the HRA and CS did not induce tachycardia. The antegrade effective refractory period of the accessory pathway (AP-ERP) was determined to be 260 milliseconds. Although tachycardia was not induced during the study, the recurrent episodes of palpitations and syncope of the patient and the finding of a low AP-ERP prompted ablation of the AP. Mapping indicated that the earliest ventricular activation with the shortest AV interval was on the mitral annulus posterolateral site (Fig. 2). A 4-mm tip electrode quadripolar ablation catheter was advanced to the left ventricle in the left anterior oblique projection (30–45°) via a retrograde aortic approach. The AP was ablated with 50-watt, 60°C RF energy delivered to the posterolateral mitral annulus (Fig. 3). Within 10 seconds of the RF ablation, the delta wave disappeared. Delivery of RF energy was continued for an additional 60 seconds. The patient was monitored for about 20 minutes for reoc-

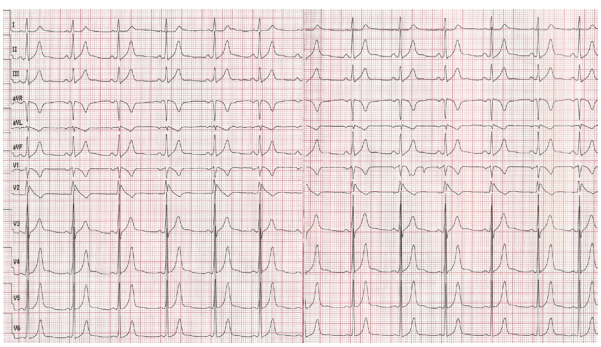

Figure 1. A 12-lead electrocardiogram (ECG) recording of the patient on admission. The ECG showed a normal sinus rhythm with evidence of ventricular preexcitation and a type 1 Brugada pattern.

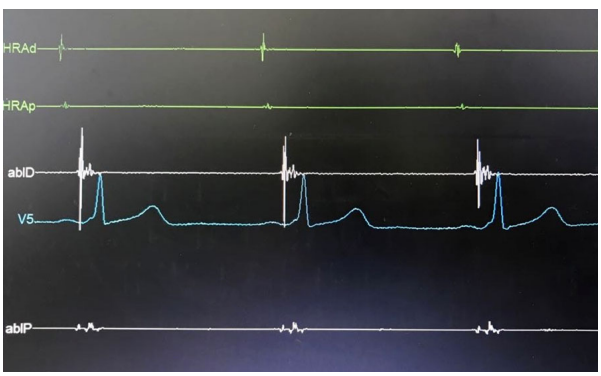

Figure 2. The earliest preexcited local ventricular activation preceded the onset of the delta wave and the shortest atrioventricular interval.

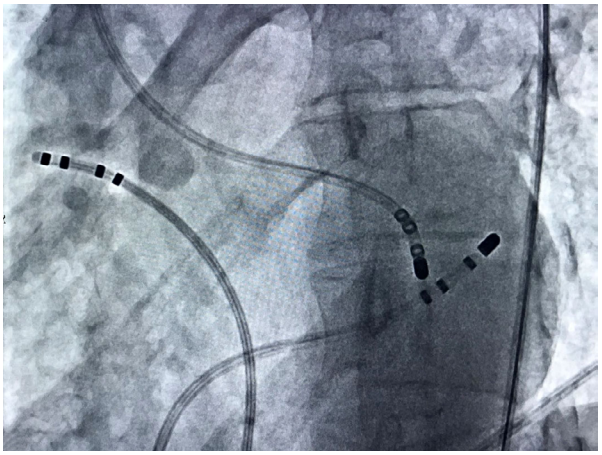

Figure 3. A fluoroscopic image demonstrating the position of the ablation catheter at the target site.

currence of a delta wave. Retrograde conduction of the AP was checked with right ventricular ramp pacing, which revealed VA dissociation consistent with successful ablation.

After ablation of the AP, a 12-lead ECG demonstrated a 0.3 mV concave-shaped ST segment elevation in derivation V2, which was compatible with a saddleback-type (type 2) Brugada pattern (Fig. 4a). In order to diagnose BrS, an ajmaline provocation test was performed. With the administration of a total dose of 50 micrograms of ajmaline, a ≥2 mm downsloping ST segment elevation was seen on derivations V1-V2, consistent with a type 1 Brugada pattern (Fig. 4b). Thereafter, programmed ventricular stimulation (PVS) was carried out from the right ventricular apex and the right ventricular outflow tract (RVOT). During the PVS from the RVOT, at a baseline drive train cycle length of 400 milliseconds with stimulus coupling intervals of 240/200/200 milliseconds, ventricular fibrillation (VF) was induced and the patient was immediately shocked with 200 joules, which converted the rhythm to sinus. Based on these findings, the patient subsequently underwent implantable cardioverter-defibrillator (ICD) implantation without complication.

DISCUSSION

BrS is a familial cardiac arrhythmic disorder that may cause SCD due to VA. Coved-type ST segment elevation is characteristic on the right precordial derivations. In this entity, which has a marked male predominance, fewer, alcohol consumption, and large meals can trigger a type 1 Brugada ECG pattern and cause a predisposition for VF. Although VF can occur at any age, 41±15 years appears to be the age of those more likely affected, particularly during rest and sleep.[6] More than 20 genes associated with BrS have been described so far. SCN5A, which encodes the alpha-subunit of the cardiac sodium channel, is the most common gene in which mutation causes this syndrome.[7] The most effective therapy to prevent SCD in these patients is ICD implantation. Quinidine, isoproterenol, and catheter ablation are also used to decrease arrhythmic events in patients with BrS.[6]

WPW syndrome is the most common cause of ventricular preexcitation. SCD is rarely seen in these

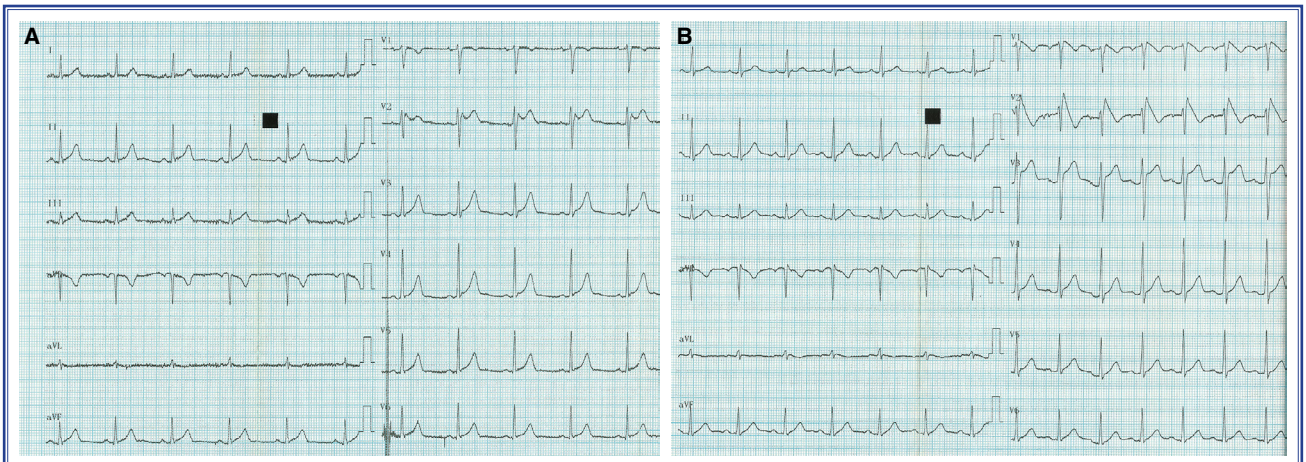

Figure 4. **(A)** After radiofrequency (RF) ablation, preexcitation disappeared on the surface electrocardiogram (ECG). The Initial type 1 Brugada pattern changed to a type 2 pattern on the ECG after successful RF ablation of the accessory pathway. **(B)** After the administration of ajmalin (50 micrograms), a coved-type ST segment elevation (type 1 Brugada pattern) was observed on the electrocardiogram in derivation V1 and V2.

patients, with a rate of 0.05%–0.2%. It has been proposed that an antegrade AP-ERP of ≤240 milliseconds is the primary finding that could lead to high ventricular rates degenerating into VF in cases of atrial fibrillation (AF) occurring in patients with WPW syndrome.[4]

The existence, type, and prevalence of supraventricular tachycardia have also been investigated in patients with BrS. In a study conducted by Takehara et al.,[8] the SCN5A gene mutation was found to be associated with atrial standstills and slowed atrial conduction, along with VA. Similarly, in another study, the prevalence of AF as well as parameters suggesting atrial vulnerability were reported to be higher in BrS cases.[9] In a study performed by Eckardt et al.,[10] in 29% of 35 patients with BrS, supraventricular tachycardia was induced during EPS: 6 had atrioventricular nodal reentrant tachycardia, 2 had atrial tachycardia, 2 had atrioventricular reentrant tachycardia, and 1 had AF.[10] The coexistence of BrS and WPW syndromes has been reported in the literature.[11–18] The clinical characteristics, ECG, and EPS findings of published cases are provided in Table 1. In a case reported by Hasdemir et al.,[13] a patient with BrS had a manifest mitral annulus anterolateral AP, and after ablation, VA was not induced during EPS. As the patient had no history of syncope or any family history of SCD, an ICD was not implanted. Eckardt et al.[11] reported a manifest WPW syndrome patient who was a survivor of sudden cardiac arrest. Coexisting BrS was diagnosed in that patient during EPS. In a case report submitted by Bodegas et al.,[12] a patient with a concealed right posterior AP had a simultaneous diagnosis of BrS, and after successful RF catheter ablation of the AP, an ICD was implanted. Takahashi et al.[19] reported a case of a patient who was a survivor of SCD with intermittent WPW syndrome. It was emphasized that early repolarization in inferior leads might be masked by ventricular preexcitation, a potential cause for documented idiopathic VF.

In our patient with WPW syndrome and BrS, the questions in our minds were which of these syndromes was responsible for the symptoms and what was the risk for SCD. The presence of an AP with a short ERP and a history of recurrent syncope led us to ablate the AP, although supraventricular tachycardia was not induced. A type 2 Brugada pattern appeared on the ECG after RF ablation of the AP, and an ajmaline provocation test was performed to diagnose BrS. After seeing a type 1 Brugada pattern with ajmaline provoca-

Table 1. Clinical characteristics, ECG and EPS findings of reported cases in literature

Reference	Age	Gender	Symptom	Syncope	AP localization	ECG	EPS	Treatment
Hasdemir et al.[13]	31	Male	Palpitation	–	M L Anterolateral	Type 2	NI	AP ablation and F-U for ICD
De Roy et al.[14]	54	Male	Palpitation	+	M Midseptal	Type 1	VF	AP ablation and ICD
Eckardt et al.[11]	30	Male	SCD	–	M R Septal	Type 3	VF	F-U for AP ablation and ICD
Jaiswal et al.[15]	23	Male	Palpitation	–	M R Posteroseptal	Type 1	VF	AP ablation and ICD
Kaiser et al.[16]	29	Male	Palpitation	–	M L Posterior	Type 1	VF	AP ablation and ICD
Ohkubo et al.[17]	29	Male	Palpitation	–	M L Anterolateral	Type 2	VF	AP ablation and RF ICD
Bodegas et al.[12]	32	Male	Palpitation	–	C R Posterior	Type 1	VF	AP ablation and ICD
Fragakis et al.[18]	58	Female	Palpitation	+	M L Posterior	Type 3	NA	RF AP ablation and RF ICD

SCD: Sudden cardiac death; M: Manifest; C: Concealed; R: Right; L: Left; F-U: Follow-up; RF: Refused; NI: Not induced; NA: Not attempt; AP: Accessory pathway; VF: Ventricular fibrillation; ICD: Implantable cardioverter-defibrillator device.

tion, BrS was diagnosed and we performed PVS for a SCD risk stratification. Although ICD implantation is recommended in the literature for patients who have spontaneous type 1 Brugada pattern on an ECG and a history of syncope,[6] given the presence of coexisting manifest ventricular preexcitation, which could disrupt symptom-disease patterns, we decided to perform PVS before the ICD implantation. Risk stratification with PVS might have a positive predictive value for future cardiac arrhythmic events.

Some patients with WPW syndrome present with syncope or SCD due to the short AP-ERP, which causes higher ventricular rate responses in cases of supraventricular tachycardia or AF. Coexisting, undiagnosed channelopathies may be responsible for syncope or SCD in some others. They have also been demonstrated in postmortem studies of asymptomatic patients with WPW syndrome.[20] Therefore, in patients with WPW syndrome and with a history of syncope, the possibility of accompanying channelopathies like BrS should be kept in mind. The coexistence of these pathologies could change diagnostic and therapeutic options.

Conclusion

AP ablation was performed successfully in this case of a patient with manifest WPW syndrome based on the electrophysiological properties of the AP and the symptoms of the patient. Coexisting BrS demonstrated different electrocardiographic features before and after RF ablation of the AP. A type 1 Brugada pattern was observed on the ECG following an ajmaline provocation. Given the combination of these 2 syndromes, PVS was performed, and induction of VF led us to implant an ICD.

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Informed Consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

Authorship contributions: Concept: G.A.; Design: G.A.; Supervision: A.K.B.; Materials: Ö.Ç., G.A.; Data collection: M.T.; Literature search: A.E.; Writing: G.A.; Critical revisions: A.K.B.

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Keywords: Brugada syndrome; syncope; Wolff Parkinson White syndrome.

Anahtar sözcükler: Brugada sendromu; senkop; Wolff Parkinson White sendromu.