

## Brugada type 1 electrocardiogram unmasked by a febrile state following syncope

### Senkop sonrası gelişen ateşle açığa çıkan Brugada tip 1 elektrokardiyogram

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**Summary** - Brugada syndrome is a genetic disease characterized by persistent or transient ST elevation in the right precordial electrocardiogram (ECG) leads with or without right bundle branch block. It represents an increased risk for sudden cardiac death despite a structurally normal heart. Brugada-type ECG can be unmasked and induced by several circumstances. We report on a 24-year-old male patient who experienced a syncopal episode and manifested Brugada type 1 ECG during a febrile state. His ECG changed to normal after treatment of fever. A single-chamber ICD was implanted to the patient because of syncope, fever-induced type I Brugada ECG pattern, and ventricular fibrillation during ajmaline challenge.

**Özet** - Brugada sendromu, elektrokardiyografide (EKG) sağ dal bloku olsun ya da olmasın, sağ prekordiyal derivasyonlarda sürekli veya geçici ST-segment yükselmesinin izlendiği genetik bir hastalıktır. Yapısal olarak normal kalplerde bile ani ölüm riski yüksektir. Bazı durumlar Brugada tipi EKG'nin açığa çıkmasına veya oluşmasına yol açabilir. Bu yazıda, senkop atağı gelişimi sonrasında ateşli dönemde Brugada tip 1 EKG değişikliği görülen 24 yaşında bir erkek hasta sunuldu. Ateşin tedavisinden sonra hastanın EKG'si tümüyle normale döndü. Hastanın geçirdiği senkop, ateşin ortaya çıkardığı Brugada tip 1 EKG ve ajmalin testinde görülen ventrikül fibrilasyonu nedeniyle hastaya tek odacıklı ICD yerleştirildi.

**B**rugada syndrome is a genetic disease characterized by persistent or transient ST elevation in the right precordial electrocardiogram leads with or without right bundle branch block and increased risk for sudden cardiac death with a structurally normal heart. The ECG manifestations can be overt or concealed. Class I antiarrhythmic drug test is used to unmask the diagnostic coved-type ECG pattern (type 1 ECG) in case it is not spontaneously present. Type 1 ECG pattern can also be unmasked by vagotonic agents, lithium, tricyclic antidepressants, severe hyponatremia, or during febrile state.<sup>[1-3]</sup>

We report on a patient whose type 1 ECG pattern during febrile state converted to normal ECG after resolution of fever.

#### Abbreviations:

BS Brugada syndrome  
ECG Electrocardiogram  
PVS Programmed ventricular stimulation

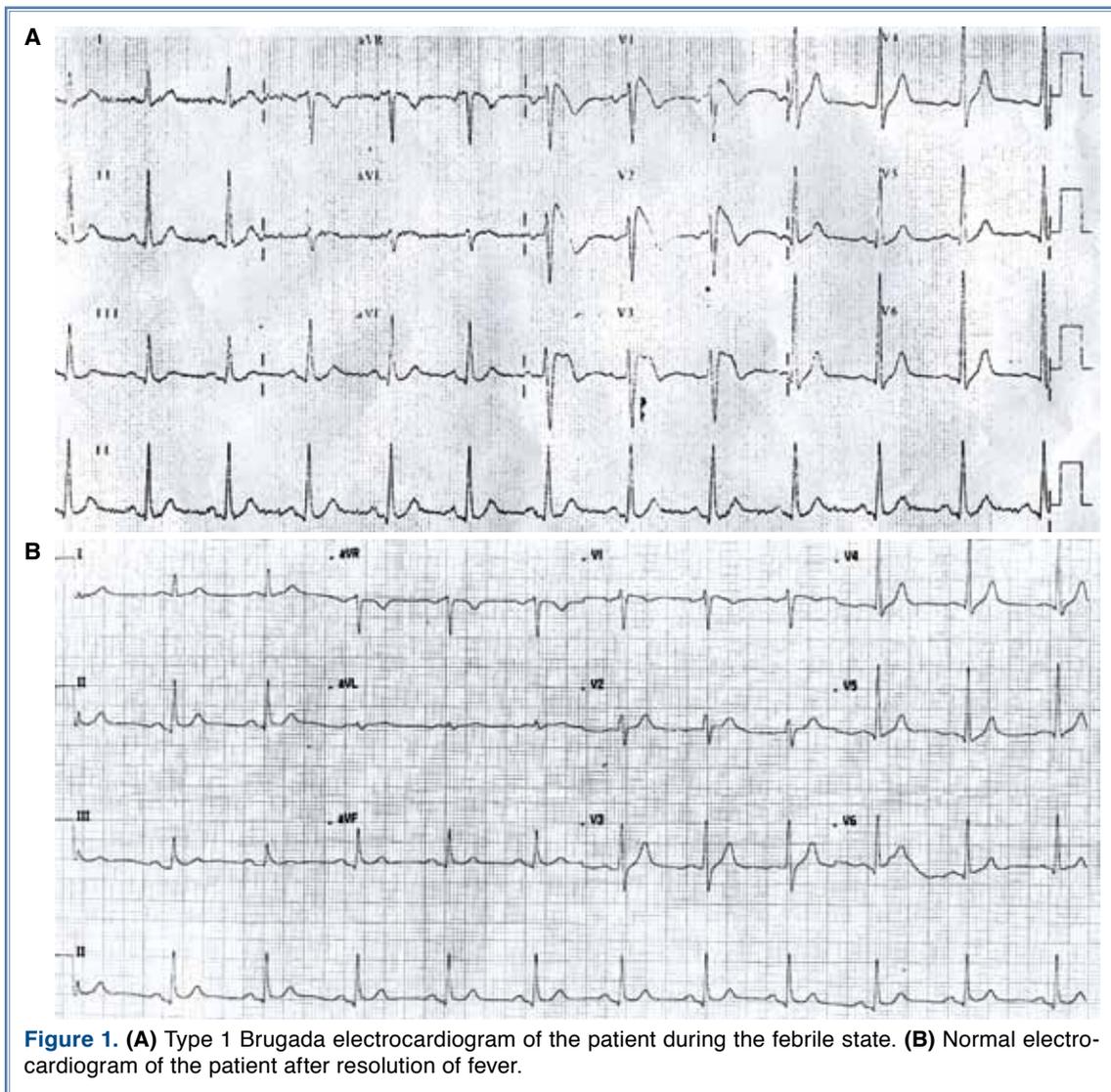
#### CASE REPORT

A 24-year-old man was admitted to the emergency department following a syncopal episode of two-hour onset. His brother reported that the patient had fallen forward at home, lost his consciousness and remained unconscious for an unknown period. He denied witnessing any seizure activity. On presentation his vital signs were as follows: blood pressure 110/72 mmHg, heart rate 89 beats/min, and body temperature 38.3 °C. Physical examination was unremarkable. The patient reported having flu-like symptoms for one to two days, which included body aches, subjective fever, chills, and decreased oral intake. He denied taking any drugs for flu-like symptoms. He also denied having chest pain or dyspnea. He reported that he had never experienced such an episode before. His family history was negative for cardiac diseases. His ECG showed

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**Figure 1. (A)** Type 1 Brugada electrocardiogram of the patient during the febrile state. **(B)** Normal electrocardiogram of the patient after resolution of fever.

downsloping ST elevation in precordial leads V1-3 consistent with type I BS (Fig. 1a). He was transferred to the cardiac intensive care unit for continuous ECG monitoring and was treated with oral paracetamol. Within 24 hours, the patient's fever decreased to 36.5 °C. Repeat ECG on the second day showed complete disappearance of the coved ST-segment elevation on admission and was totally normal (Fig. 1b). Serum troponin T level was also normal. Echocardiography showed no structural cardiac abnormality with an ejection fraction of 60%. Subsequent ambulatory ECG monitoring showed no evidence for rhythm disturbances. Propafenone did not induce type I Brugada ECG pattern. During ajmaline challenge, ventricular fibrillation was induced and the patient was successfully defibrillated. On the third day of admission, the patient underwent an electrophysiological study where

ventricular arrhythmia could not be induced by programmed ventricular stimulation. A single-chamber ICD was implanted to the patient because of syncope, fever-induced type I Brugada ECG pattern, and ventricular fibrillation during ajmaline challenge. He was discharged on the tenth day. He did not take any regular medication and had no clinical event during a 10-month follow-up period.

## DISCUSSION

Brugada syndrome is a genetic disease characterized by persistent or transient ST elevation in the right precordial leads with or without right bundle branch block and an increased risk for sudden cardiac death despite a structurally normal heart. It is definitively diagnosed when a type 1 ST-segment elevation is ob-

served in more than one right precordial leads (V1 to V3) in the presence or absence of a sodium channel blocking agent, in conjunction with one of the following: documented ventricular fibrillation, polymorphic ventricular tachycardia, family history of sudden cardiac death before 45 years of age, coved-type ECG in family members, inducible ventricular tachycardia with programmed electrical stimulation, syncope or nocturnal agonal respiration. Interestingly, changes in ECG that are associated with BS are often dynamic or concealed and are unmasked by sodium channel blockers, fever, vagotonic agents, tricyclic antidepressants, lithium, and severe hyponatremia.

Brugada syndrome is inherited as an autosomal dominant trait, with approximately 18-30% of the cases showing mutations in the cardiac sodium channel alpha subunit gene (SCN5A). These mutations impair the function of the sodium channel current, leading to an opposed outward shift of the net transmembrane current at the end of phase 1 of the right ventricular epicardial action potential.<sup>[1-3]</sup>

Dumaine et al.<sup>[4]</sup> postulated that, during the depolarization of cardiac myocytes, the net sodium current represents a balance between the (rapidly-decaying) inward sodium current and the transient outward current. They found that, in cultured right ventricular cardiomyocytes, the rate of decay of the inward current was temperature-sensitive in epicardial, but not endocardial cells, which might predispose some Brugada patients to arrhythmias during the febrile state. Keller et al.<sup>[5]</sup> identified a novel missense mutation (F1344S) in the SCN5A in a 42-year-old patient who had presented with the febrile state and developed ventricular fibrillation. Samani et al.<sup>[6]</sup> also reported a novel mutation (V1340I) of the SCN5A in a BS patient with worsening arrhythmic episodes only during a febrile illness. Using the patch-clamp technique, they showed that the V1340I mutation of the SCN5A attenuated the sodium current at the hyperthermic state, which might play an important role in arrhythmogenesis during the febrile state.<sup>[6]</sup> Unfortunately, we did not perform genetic testing in our patient.

As in our case, unmasking of the type 1 ECG and/or the development of ventricular tachycardia/fibrillation have been described in pyrexial states.<sup>[7,8]</sup> In contrast to these reports, the unfebrile state ECG was totally normal in our case.

Junttila et al.<sup>[9]</sup> reported that most of their patients with fever and Brugada-type ECG developed malignant arrhythmias shortly after the onset of fever, re-

gardless of the existence of a predisposing genetic base. Thus, fever should be vigorously treated with antipyretics in these patients. Loop recorder monitoring is recommended for therapeutic decision of these patients.<sup>[10]</sup> As some drugs like sodium channel blockers, anesthetics, cocaine, tricyclic antidepressants, and antihistamines can unmask or induce the Brugada ECG pattern and predispose the patients to malignant arrhythmias,<sup>[9]</sup> these drugs should be avoided in the treatment of specific diseases in BS patients. Being a trigger of ventricular arrhythmias, fever should be treated rapidly with innocent drugs in BS.

The role of PVS in BS is controversial.<sup>[11,12]</sup> In a meta-analysis, Paul et al.<sup>[13]</sup> found that PVS did not have a significant role with regard to arrhythmic events during follow-up of BS patients, raising doubt as to the role of PVS for risk stratification of BS patients. They concluded that BS patients who survived sudden cardiac arrest showed the highest chance for developing ventricular tachycardia/fibrillation during follow-up. In our patient, the PVS failed to induce ventricular arrhythmia despite the presence of syncope, ventricular fibrillation during ajmaline challenge test, and type 1 ECG during the febrile state. He underwent ICD implantation despite a negative electrophysiological study.

In conclusion, BS should be kept in mind in a patient with a history of cardiac arrest and fever. In addition, an accurate diagnosis and prompt treatment of fever are essential in Brugada patients to prevent ventricular arrhythmias.

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- Key words:** Brugada syndrome; electrocardiography; fever/complications; syndrome.
- Anahtar sözcükler:** Brugada sendromu; elektrokardiyografi; ateş/komplikasyon; sendrom.