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EC PAEDIATRICS
Case Report

# Fever-Induced Brugada Pattern: Temperature Matters

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## Abstract

Brugada syndrome (BrS) is an inherit channelopathy presenting with a characteristic electrocardiogram (ECG) and a tendency to develop malignant polymorphic ventricular arrhythmias that may lead to syncope or sudden cardiac death (SCD). Fever has been reported not only to accentuate the BrS ECG pattern but also to actually trigger ventricular arrhythmias. Fever, both after immunization or as a response to infection is very common in children, and is well known to associated with febrile seizures. We report a case of an asymptomatic child with dynamic electrocardiographic changes, a type 1 BrS pattern ECG, induced by fever.

***Keywords:*** *Brugada Syndrome; Brugada Pattern; Right Bundle Branch Block; Electrocardiography; Fever; Children*

## Abbreviations

BrS: Brugada syndrome; ECG: Electrocardiogram; RBBB: Right Bundle Branch Block; SCD: Sudden Cardiac Death; ICD: Implantable Cardioverter Defibrillator

## Introduction

Brugada syndrome (BrS) is an autosomal dominant inherited channelopathy, characterized by a typical pattern electrocardiogram (ECG), associated with risk of potentially lethal ventricular arrhythmias and sudden cardiac death in a structurally normal heart. BrS is diagnosed based on characteristic and pathognomonic ECG findings [1].

Initially, 3 ECG pattern types were described in patients with BrS, although only type 1 changes are considered diagnostic. Type 1 ("coved type") is characterized by a right bundle branch block-like morphology (RBBB), an ST-segment elevation > 2 mm in >1 right precordial lead (V1 to V3), with the typical coved appearance, and followed by a negative and symmetric T-wave [2].

Although BrS it typically presents in young adults, it is also known to present in children and infants, especially in the presence of fever, and becomes a real diagnostic challenge for the paediatrician [3].

Fever in children is one of the most clinical symptoms, often causing anxiety among parents and caregivers. Generally, fever is not dangerous in itself, as it is only a symptom [4]. Febrile seizures are the most common cause of pediatric seizures. But in BrS, fever should be considered in a special way because of its effects on the ECG, and the possibility of fever-triggered cardiac events [5,6].

## Case Report

A previously healthy 4-year-old boy was in control in the Pediatric Cardiology Department because his father, a 30-year-old man, had just been diagnosed with BrS, with implantable cardioverter defibrillator (ICD) but without genetic testing yet. A father´s cousin died of sudden cardiac death when he was 40-year-old in his country, Bulgaria. His medical history was insignificant (no syncope, palpitations or febrile seizures), his first cardiac study was also normal (physical examination, ECG, echocardiography). As his parents were advised, the child went to the Emergency Service because he had fever (no vaccine recently), due to a respiratory viral infection without complications. The ECG performed when he had fever, 39.5ºC, revealed a normal sinus rhythm but with a type 1 Brugada, which disappeared after the fever subsided with antipyretic drugs (Figure 1). A few months later, the same dynamic changes in the ECG occurred with another febrile episode due to another respiratory infection (Figure 2).

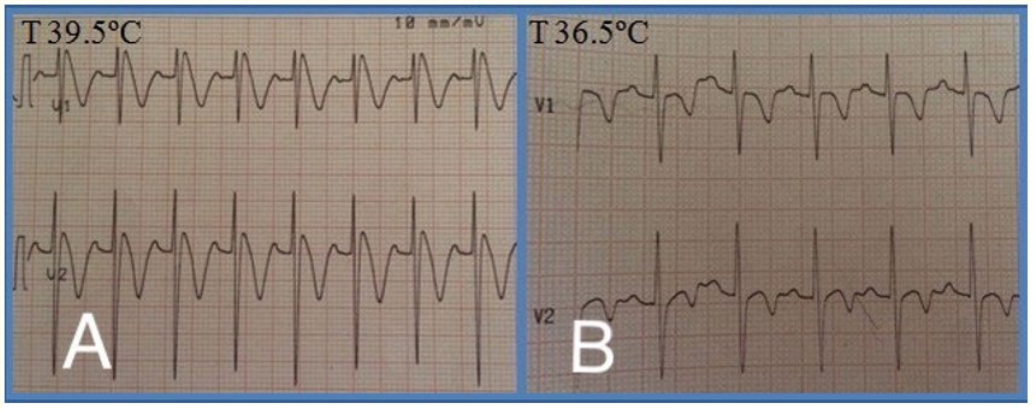


***Figure 1:*** *First febrile episode. The ECG performed with fever, temperature 39.5ºC (A), revealed a normal sinus rhythm but with a type 1 Brugada pattern ECG (right bundle branch block-like morphology, cove-shaped ST elevation in right precordial leads > 2 mm, followed by a negative T wave), which disappeared after the fever subsided with antipyretic drugs, temperature 36.5ºC (B).*

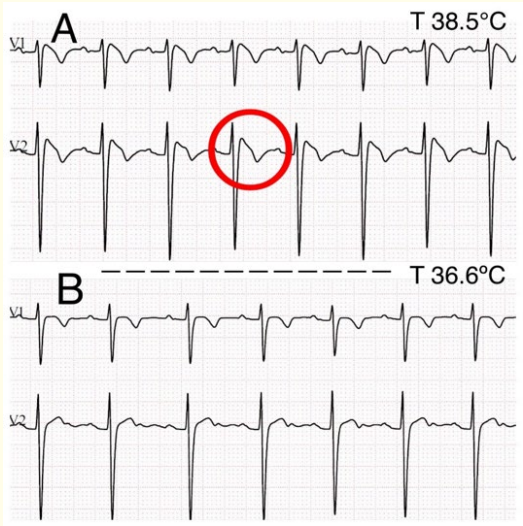


***Figure 2:*** *Second febrile episode. The ECG performed with fever, temperature 38.5ºC (A), revealed a type 1 Brugada pattern ECG, which disappeared after the fever subsided with antipyretic drugs, temperature 36.6ºC (B).*

After obtaining informed consent for genetic testing, the study did not reveal any pathogenic variant in genes responsible for channelopathies (SCN5A, SCN1B, SCN2B, SCN3B, SCN10A CACNA1C, CACNA1D, CACNA2D1, CACNB2, GPD1L, KCND2, KCND3, KCNE3, KCNE5, KCNH2, KCNJ8, ABCC9, ANK2, ANK3, FGF12, HCN4, PKP2, RANGRF, SLMAP, TRPM4).

Our patient was diagnosed with BrS and conservative measures were advised, including the avoidance of drugs that can provoke Brugada ECG changes available at www.brugadadrugs.org and rapid antipyretic treatment for fever. The patient is being monitored by an insertable cardiac monitor (ICM), we use Reveal Link ICM®, and so far, no arrhythmic events have been detected.

## Discussion

In the present case, the dynamic ECG changes were evident when the fever was present and disappeared once the temperature returned to normal. Cardiac depolarization occurs as a result of sodium channel activation, and in BrS, the mutated sodium channels result in temperature-dependent ionic changes that cause characteristic BrS ECG patterns during fever.

Genetic testing is recommended in those exhibiting a type 1 Brugada ECG pattern (either spontaneous or provoked). The first identified genetic alteration was in the SCN5A gene, this gene encodes the alpha subunit of the cardiac sodium channel Nav1.5. However, more than 500 pathogenic variations have been associated with BrS so far. Despite this progress in genetic diagnosis, nearly 70% of families remain without an implicated genetic variant, as is the case in our family [1].

Although negative genetic study, our patient is considered to carry the disease according to the new 2013 criteria [7]. The diagnosis is also confirmed by using the recent developed Shanghai score, that recognizes the limitations of induced type 1 ECG changes in isolation, and recommends additional information (clinical history, family history, and/or genetic testing results) to make a definite diagnosis [2].

Fever-triggered cardiac events should also raise the suspicion of BrS, and the ECG is a crucial tool in the workup of febrile seizures [8,9].

This report emphasises that pediatric emergency specialists should be aware of these transient ECG changes suggestive of BrS related to fever and should treat fever aggressively [10].

## Conclusion

Fever unmasks type 1 ECG pattern of BrS in an apparently healthy child. We advise to perform ECG when children of families diagnosed with BrS are admitted to pediatric emergency, and fever must be abated with prompt antipyretic measures.

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## Conflict of Interest

The authors declare no conflicts of interest.

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