

## CASE REPORT

# A tick-borne illness unmasking asymptomatic Brugada syndrome

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## Abstract

Brugada syndrome is an important cause of sudden cardiac death and should be recognized in asymptomatic patients with characteristic electrocardiographic (ECG) findings. We report a case of a 59-year-old male who presented with fever and generalized malaise after a camping trip with confirmed tick exposure. Initial diagnostic work-up included an ECG, which showed incidental ST-segment elevation in the right precordial leads consistent with a type 1 ECG pattern seen in Brugada syndrome. He was diagnosed with fever-induced Brugada syndrome and treated with doxycycline and antipyretics. The type 1 ECG pattern resolved a few hours later with a resultant right bundle branch block. Implantable cardioverter-defibrillator implantation was not indicated after risk stratification. The case highlights the importance of considering Brugada syndrome in patients with characteristic ECG changes in the setting of fever, and reviews the latest criteria for diagnosis, management and risk stratification of this fatal condition.

## INTRODUCTION

Brugada syndrome is an important cause of sudden cardiac death (SCD) and should be recognized in asymptomatic patients with characteristic electrocardiographic (ECG) findings. Fever is an important factor that has been shown to induce a type 1 ECG pattern in patients with asymptomatic Brugada syndrome. It is estimated that the prevalence is 20 times higher among patients presenting with fever than in afebrile patients. [1]. We present a case of a middle-aged male who presented with high fever due to a tick-borne illness that unmasked a type 1 ECG pattern consistent with a diagnosis of Brugada syndrome, and discuss the management and high-risk features associated with Brugada syndrome.

## CASE REPORT

A 59-year-old male presented to the emergency department (ED) with a 4-day history of fever and arthralgias. This was preceded by a camping trip after which he noted multiple ticks on his body. His temperature has been reaching 39.5°C, associated

with a headache, malaise and lethargy. He denied rashes, abdominal pain, diarrhea or urinary changes. A past medical history was significant for hypertension and hyperlipidemia. Family and social histories were unremarkable for SCD or arrhythmias in first-degree relatives.

On examination, the patient's vital signs were normal apart from fever and mild tachycardia. His temperature was 39.3°C, blood pressure 117/73 mmHg, heart rate 97/min, respiratory rate 22/min and oxygen saturation of 96% on room air. He appeared to be in mild distress secondary to high fever. Skin examination was normal without rashes. Heart auscultation revealed normal S1 and S2, without murmurs or gallops. Lung, abdominal and neurologic examinations were unremarkable.

Routine laboratory tests were obtained including a complete blood count and a comprehensive metabolic panel. The patient's leukocyte count was 2.1k/μl, with the differential showing 88% neutrophils, 7% lymphocytes and 4% monocytes. The hemoglobin level was 12.1 g/dl and platelet count was 87k/μl. The liver enzymes were mildly elevated with alanine aminotransferase

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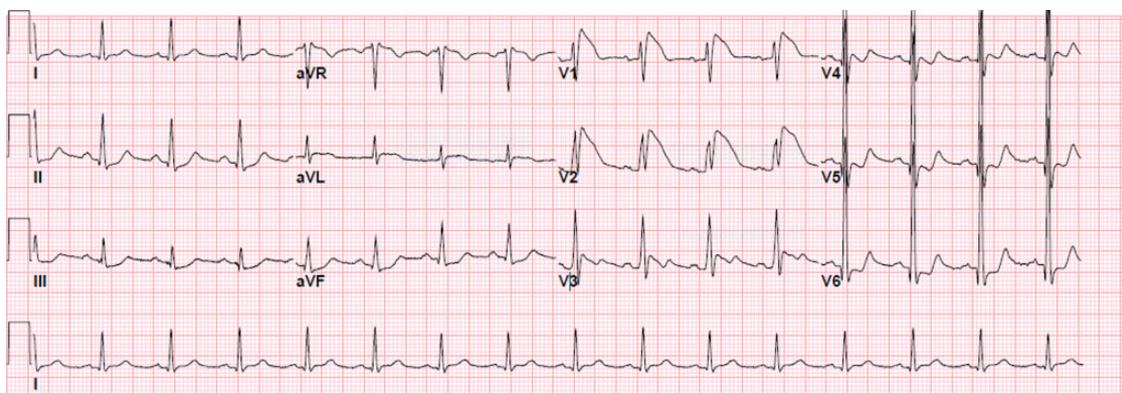


Figure 1: Type 1 ECG pattern characterized by coved ST-segment elevation followed by T-wave inversions in V1 and V2.

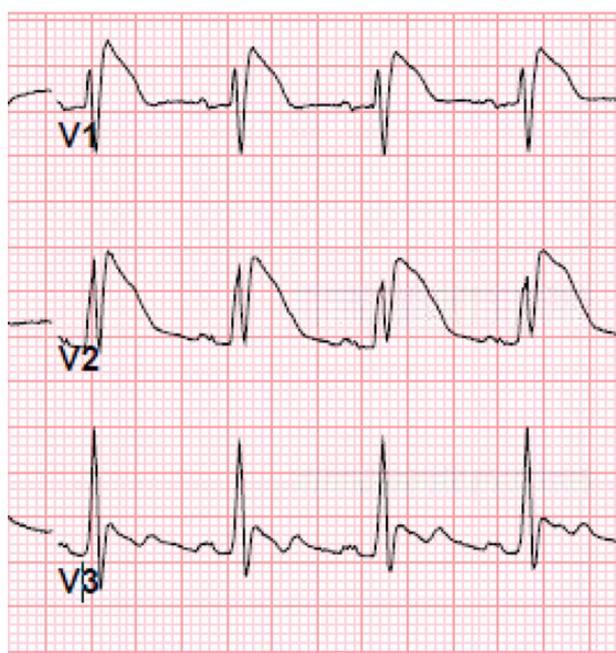


Figure 2: Close-up of type 1 ECG pattern in V1 and V2.

of 72 U/l and aspartate aminotransferase of 83 U/l. Alkaline phosphatase, total bilirubin and INR were normal.

An ECG was obtained as part of the initial work-up in the ED (Fig. 1). He was noted to have coved ST-segment elevation followed by T-wave inversions in the right precordial leads (Fig. 2). This prompted a rapid cardiology consult as well as measurement of cardiac enzymes. Cardiac enzymes were undetectable with troponin I of <0.02 ng/ml (normal 0.00–0.04 ng/ml) and remained negative. It was felt that the ECG changes were most consistent with a type 1 Brugada pattern given the lack of symptoms (i.e. chest pain) and the presence of high fever and negative cardiac enzymes.

The patient was admitted to a telemetry unit for close monitoring. Laboratory tests for DNA PCR for Lyme disease, human monocytic ehrlichiosis (HME), human granulocytic anaplasmosis and Rocky Mountain spotted fever were requested. He was started on doxycycline due to the high clinical suspicion for a tick-borne illness. His temperature was managed with acetaminophen (paracetamol), and repeat ECG 3 h later showed resolution of type 1 ECG pattern and the appearance of a right bundle branch

block (Fig. 3). It was determined that the patient developed a fever-induced type 1 ECG pattern due to a tick-borne illness. This diagnosed him with Brugada syndrome.

The patient denied prior symptoms suggestive of arrhythmias (i.e. syncope), and reported no history of cardiac arrest. Further cardiac work-up in the acute setting in the form of an electrophysiologic study or implantation of an implantable cardioverter-defibrillator (ICD) was not indicated based on the most recent recommendations [2]. The tick-borne work-up was positive for HME and negative for other tick-borne illnesses. The patient showed marked clinical improvement over the next 2 days in the hospital and was discharged with arrangement for outpatient cardiology follow-up for Brugada syndrome.

## DISCUSSION

Brugada syndrome was first described in 1992 as a group of characteristic ECG findings associated with a high risk of SCD in patients with a structurally normal heart. It is believed to be responsible for 4–12% of all SCD cases, and up to 50% of SCD in patients with structurally normal hearts [3]. The disease is genetically inherited with an autosomal dominant pattern of transmission with incomplete penetrance. Multiple gene mutations have been identified that encode subunits of the cardiac sodium, potassium and calcium channels, but only ~35% of patients have been determined to have a genetic cause (most commonly a mutation in the SCN5A gene) [4, 5].

Three ECG patterns are described in relation to Brugada syndrome. Type 1 is characterized by coved ST-segment elevation  $\geq 2$  mm followed by a negative T-wave, with little or no isoelectric separation, present in  $\geq 1$  precordial leads (V1 and/or V2 positioned in the second, third or fourth intercostal space). Type 2 is characterized by ST-segment elevation  $\geq 2$  mm, a trough displaying  $\geq 1$  mm ST elevation, followed by a positive or biphasic T-wave that results in a saddle-back configuration in the same leads. Type 3 is characterized by right precordial ST-segment <1 mm either with a coved-type or saddle-back morphology in the same leads [2].

According to the expert consensus statement [2] by the Heart Rhythm Society (HRS), European Heart Rhythm Association (EHRA) and Asia Pacific Heart Rhythm Society (APHRS), the diagnosis of Brugada syndrome is made when a type 1 ECG pattern is seen spontaneously, as with this case, or after provocative drug test with intravenous administration of a class I antiarrhythmic drug. An incidental type 2 or 3 ECG pattern is non-diagnostic unless a provocative drug test induces a type 1 ECG pattern in these

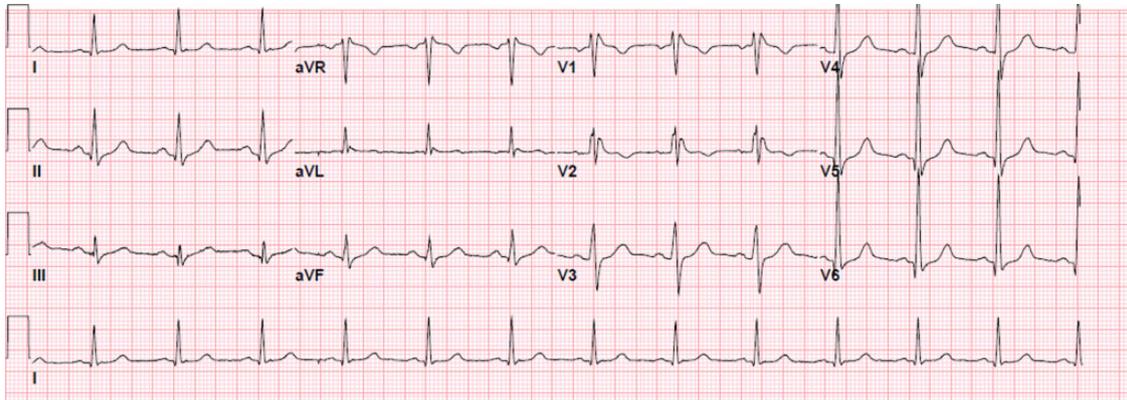


Figure 3: Repeat ECG showing resolution of type 1 ECG pattern, but demonstrating right ventricular conduction delay with prolonged QRS duration, rSR', and T-wave inversion in V1 and V2.

patients [6]. This update in guidelines omits the need for a family history of SCD or previous episodes of ventricular arrhythmias to secure the diagnosis, as with the 2005 second consensus conference on Brugada syndrome [2].

The recommendations for treatment once the diagnosis of Brugada syndrome is made are 2-fold—lifestyle changes that involve avoidance of drugs that can induce ST-segment elevation in the right precordial leads, avoidance of excessive alcohol intake, prompt treatment of fever with antipyretics and ICD implantation for patients who are survivors of a cardiac arrest and/or are considered high risk [6]. As of now, not enough evidence exist to support ICD implantation in asymptomatic Brugada syndrome patients with a drug-induced type 1 ECG pattern and/or on the basis of a family history of SCD alone.

Risk stratification to identify patients at risk of SCD is an important aspect of management and remains an area under research. High-risk features seem to include syncope in patients with a spontaneous type 1 ECG pattern at baseline, a fragmented QRS [7], male gender and spontaneous atrial fibrillation. The risk of lethal arrhythmias and SCD in asymptomatic patients is unclear and varies across studied populations from 1 to 8% at a mean of 30-month follow-up period [6]. The inducibility of ventricular tachycardia/ventricular fibrillation (VT/VF) during electrophysiology study (EPS) is debatable as a method of identifying high-risk individuals or predicting outcomes, and probably should not be routinely performed based on the current evidence [6, 8]. The PRELUDE registry failed to support the view that lack of inducibility has a negative predictive value in Brugada syndrome [9]. Furthermore, although inducibility was associated with a shorter time to first arrhythmic event in the FINGER registry in the univariate analysis, it did not predict arrhythmic events in the multivariate analysis [10].

In summary, Brugada syndrome remains an underdiagnosed cause of SCD. The association of elevated core body temperature with a type 1 ECG pattern is diagnostic of the syndrome. Patients should be thoroughly questioned to identify any possible symptomatology suggestive of ventricular arrhythmias, in which case ICD implantation is warranted. In patients without previous symptoms, close follow-up is recommended and prognosis is favorable.

## AUTHORS' CONTRIBUTION

All authors had access to the data and a role in writing the manuscript.

## CONFLICT OF INTEREST STATEMENT

None declared

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