World Journal of Cardiology

Online Submissions: http://www.wjgnet.com/1949-8462office
wjc@wjgnet.com
doi:10.4330/wjc.v4.i3.84

World J Cardiol 2012 March 26; 4(3): 84-86
ISSN 1949-8462 (online)

CASE REPORT

Brugada electrocardiographic pattern induced by fever

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Received: November 22, 2011 Revised: December 13, 2011
Accepted: December 20, 2011
Published online: March 26, 2012

Abstract

Brugada syndrome is a major cause of sudden death in young adults. Fever has been described to induce a Brugada-type electrocardiogram in asymptomatic patients with a negative family history, to disclose Brugada syndrome and to increase the risk of death and induce T wave alternans in patients with diagnosed Brugada syndrome. Risk stratification is challenging and demands a careful evaluation. Here we present 2 case reports and review the literature.

Key words: Brugada syndrome; Phenotype; Fever; Electrocardiogram

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Lamelas P, Labadet C, Spernanzoni F, Saubidet CL, Alvarez PA. Brugada electrocardiographic pattern induced by fever. *World J Cardiol* 2012; 4(3): 84-86 Available from: URL: http://www.wjgnet.com/1949-8462/full/v4/i3/84.htm DOI: http://dx.doi.org/10.4330/wjc.v4.i3.84

INTRODUCTION

Brugada syndrome (BS) is a channelopathy that may be familial or sporadic and is a major cause of sudden death in young men with no evidence of structural heart disease[1,2]. The electrocardiogram (ECG) is characterized by persistent ST segment elevation in the right precordial leads unrelated to ischemia, right bundle branch block and rapid polymorphic ventricular tachycardia capable of degenerating into ventricular fibrillation[3]. The ECG pattern may be dynamic and is often concealed. Sodium channel blockers, tricyclic antidepressants, anesthetics, cocaine, methadone, antihistamines, electrolyte imbalances and fever are recognized inducers[4]. Here we present 2 patients with Brugada-type ECG induced by fever, and review the current literature.

CASE REPORT

Case 1

A 48-year-old male, renal transplant recipient was admitted to our hospital because of pneumonia. He denied a history of syncope or palpitations and his family history was negative for sudden death. On physical examination, his temperature was 39 ℃ and his heart rate was 120 beats/min. A cardiac examination was unremarkable. Because of atypical chest pain on admission, an ECG was performed that revealed sinus tachycardia and saddleback ST segment elevation in V1 and V2 (Figure 1, Panel A). Initial laboratory data showed an increased creatinine level (1.9 mg/dL; normal range, 0.5-1.5 mg/dL) and normal

Table 1 Brugada-type electrocardiogram induced by fever

Author	Age	Sex	Cause of fever	Test performed and results	Follow up	Events during follow up
Kum *et al*[5]	39	M	Pneumonia	Drug challenge (Flecainide); positive	NM	N/A
Patruno *et al*[6]	53	M	Influenza-like febrile illness	Drug challenge (Flecainide); positive	2 yr	No events
Saura *et al*[15]	69	M	Pneumonia	Drug challenge (Flecainide); negative	NM	N/A
Shinohara *et al*[16]	64	M	Common cold	Drug challenge (Pilsicainide); Positive; EPS PES positive ICD	1 yr	No VF was observed
Ott *et al*[17]	27	F	Viral pharingitis	Echocardiogram; normal	NM	N/A
Sanchez *et al*[18]	54	F	Klebsiella oxitoca catheter associated bacteremia	Echocardiogram; normal radionuclide stress test	NM	N/A
Wakita *et al*[19]	35	M	Measles	Drug challenge (Pilsicainide); positive; patient denied EPS	NM	N/A
Aramaki *et al*[20]	61	M	NM	Drug challenge (Pilsicainide); positive; coronary angiography; EPS PES	NM	N/A
	59	M	NM		NM	N/A
Susuki *et al*[21]	51	M	Pneumonia	Echocardiogram; AS HQ; serial cardiac enzymes negative	NM	N/A
Kalra *et al*[22]	35	M	Pneumonia	Drug challenge (Flecainide); positive; EPS negative	NM	N/A
Gavrielatos *et al*[23]	45	M	Cholecystitis	Holter: Low heart rate variability; SAECG: Positive late potentials; drug challenge test (Procainamide) positive; patient denied EPS and coronary angiography	NM	N/A
Mok *et al*[24]	53	M	Cholangitis	Drug challenge (Flecainide) borderline positive; cardiac MRI no structural heart disease; EPS PES negative	2 yr	No clinical events

M: Male; NM: Not mentioned; N/A: Not applicable; EPS: Electrophysiological study; SAECG: Signal average electrocardiogram; MRI: Magnetic resonance imaging; PES: Programmed electrical stimulation; VF: Ventricular fibrillation; ICD: Internal cardioverter defibrillator; AS HQ: Anteroseptal hypokinesis.

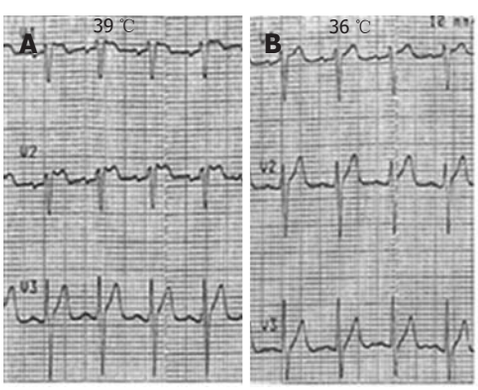

Figure 1 Electrocardiogram case 1. A: Saddleback ST segment elevation in V1 and V2 during the febrile episode; B: Normal electrocardiogram when the fever resolved.

potassium level (4.2 mEq/L). Troponin, creatine kinase (CK) and CK-MB were negative. An echocardiogram showed normal systolic function and absence of segmental abnormalities. ECG findings resolved when the patient became afebrile even though sinus tachycardia persisted (Figure 1, Panel B). One year after discharge, the patient remained alive with no episodes of syncope.

Case 2

A 69-year-old male was admitted to our hospital with a complicated urinary tract infection. His past medical history was significant for diabetes mellitus type 2 and benign prostatic hypertrophy. On physical examination his blood pressure was 120/80 mmHg, his heart rate was 80 beats/min and his temperature was 38 ℃. Cardiac examination was unremarkable. His blood chemistry was within the normal range, including potassium (4.6 mEq/L). A routine ECG on admission revealed coved-shaped ST elevation in leads V1 through V3 (Figure 2, Panel A). An ECG performed when the patient was without fever showed incomplete right bundle branch block (Figure 2, Panel B). A transthoracic echocardiogram disclosed normal systolic function and absence of segmental wall motion abnormalities.

The family history was negative for syncope or sudden cardiac death. The patient was evaluated by cardiac electrophysiology, and conservative management was indicated. Two years after being discharged the patient remains well and free of cardiac events.

DISCUSSION

Predominance of outward ionic current (Ito) at the end of phase 1 of the action potential either because of an increase of its magnitude or because of a decrease in inward currents (INa, ICaL) causes loss of the action potential dome and marked shortening of the action potential. The greater density of the Ito current in the epicardium causes a transmural dispersion of repolarization that manifest as a J wave or ST-segment elevation[5]. Accelerated inactivation of the sodium channel can be temperature-sensitive[6,7]. Fever might also impair conductance of the sodium channel[8].

Fever has been described to induce a Brugada-type ECG pattern in asymptomatic patients with a negative family history (Table 1)[9], disclosing Brugada syndrome[10-12], and to increase the risk of death, to induce

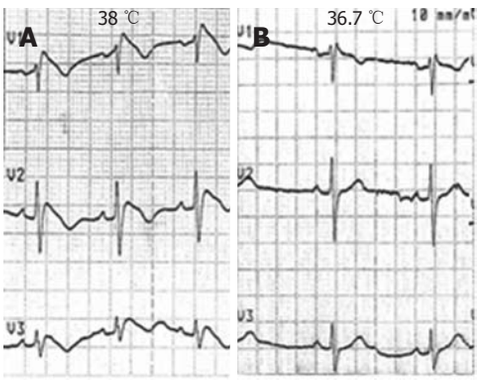

Figure 2 Electrocardiogram case 2. A: Coved shaped ST elevation in leads V1 through V3 during the febrile episode; B: Incomplete right bundle branch block when the fever subsided.

T wave alternans and premature ventricular beats in patients with diagnosed Brugada syndrome[13,14].

Risk stratification of asymptomatic patients with a Brugada-type ECG induced by fever and a negative family history remains a matter of debate. According to current guidelines, careful follow-up would be an appropriate option[1]. The diagnostic value of a drug challenge test as well as electrophysiological studies in this population is uncertain.

Type I and Ⅱ Brugada ECG patterns should be included in the differential diagnosis of ST elevation in a patient with fever. Reversibility of ECG alterations when the patient is normothermic is crucial. Rapid treatment and consultation in an emergency department in case of fever should be considered. Asymptomatic patients with a Brugada-type ECG induced by fever with a negative family history of syncope or sudden death seem to have good prognosis, but careful follow-up is needed until we better define the clinical implications of this entity.

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