Fascicular Left Ventricular Tachycardia Associated with Energy Drink Consumption

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Abstract

Idiopathic Fascicular Ventricular Tachycardia (IFVT) of the left ventricle is an infrequent form of Ventricular Tachycardia (VT), usually occurring in patients without structural heart disease, sensitive to verapamil and whose mechanism is reentry using the specific conduction system of the left ventricle. The most frequents are VTs that compromise the posterior fascicle, constituting 90% of cases. Energy drinks have been associated with supraventricular and ventricular cardiac arrhythmias in young patients without known heart disease. We present the case of a 36-year-old male patient, with no known medical history, who after ingesting an energy drink (VOLT®) suddenly presented a non-radiated precordial pain and palpitations, was translated to emergency room, where an Electrocardiogram (ECG) was performed showing a VT with wide QRS and right bundle branch block morphology, with an axis deviated to the left, it was decided to administer verapamil 5 mg intravenously, achieving reversion to sinus rhythm, progressive elevation of troponin T was observed, for which cardiac catheterization was performed without evidence of lesions in the coronary arteries. The presence of structural heart disease was ruled out with cardiac magnetic resonance imaging. The diagnosis of FVT triggered by the consumption of an energy drink in a structurally healthy heart was established, treatment with bisoprolol 2.5 mg orally daily was indicated, caffeine intake was prohibited, and a schedule of outpatient controls was established.

Keywords: Idiopathic fascicular ventricular tachycardia • Energy drink • Arrhythmia

Introduction

Energy drinks (ED) are consumed by 30% to 50% of adolescents and young adults first-world countries. They are characterized by their high capacity to supply energy, increase alertness, and improve physical resistance [1]. The main ingredient of ED is caffeine, 237 ml of ED contains 140 mg of this substance, while the same amount of black tea or instant coffee contains 85 mg [2]. Caffeine belongs to the family of methylxanthines. High concentrations of this product inhibit phosphodiesterase 3, increase cyclic AMP levels and interfere with GABA-A receptors, causing bronchodilation, tremor, and tachycardia due to its positive chronotropic effect. they increase the sensitivity of contractile proteins to calcium, which makes them it a powerful proarrhythmic agent. It is estimated that 100 mg of this element increases alertness in humans, 250 mg increases blood pressure and 1.2 grams can be lethal [3].

The main problem with EDs is that, in addition to caffeine, they contain other substances such as guarana, ginseng and taurine in variable amounts that can generate uncertain interactions [4]. Guarana is a Brazilian plant that contains guaranine, which is another xanthine but with double of effects compared to the same amount on caffeine (2% to 4%) [5]. Furthermore, while the rate of coffee consumption is generally limited by its temperature, EDs can be drink in large amounts and in a short period of time, resulting in peaks of high concentration of caffeine in peripheral blood [2]. It is important to point out that high concentrations of this substance in the blood decrease serum potassium levels, which can trigger ventricular arrhythmias and sudden death [6].

Case Report

A 36-year-old male patient, with no medical history, long-time athlete, who after ingesting 250 ml of an ED prior to sports activity (playing soccer), presents chest pain of sudden onset, not irradiated, which did not disappear with rest and palpitations, he was translated to the emergency room of a private care center where an ECG was performed on admission, which showed tachycardia with wide QRS, right bundle branch block morphology and axis deviation on the left (Figure 1), adenosine 6mg was administered without success, then he received 5 mg of intravenous Verapamil achieving reversion to sinus rhythm (Figure 2). Laboratory tests were requested (Table 1) where troponin elevation was observed, emergency coronary angiography was performed with no evidence of obstructive coronary artery disease. To rule out associated cardiomyopathy, cardiac magnetic resonance imaging was performed, which did not show any structural pathology. Control laboratories showed paraclinical improvement with normalization of cardiac enzymes (Table 1).

We decided to discuss the case with the electrophysiology service, who stated that in view of being a first isolated event, a baseline ECG without alterations and the absence of structural pathologies, the patient did not present criteria for an electrophysiological study or placement of an automatic implantable defibrillation (DAI), he was discharged with outpatient medical treatment (Bisoprolol 2.5 mg VO OD) and a ban on the intake of caffeine. (Table 2). The patient is in routine follow-up and asymptomatic to date.

Table 1. Admission laboratories

CPK – MB Serum calcium	4,34 ng/ml
Troponine	0.125 ng/ml
asymptomatic to date.	9.6 mg/dl
Serum magnesium	2.12 mg/dl
Serum sodium	139 mg/dl
Serum potassium	3.48 mg/dl
Serum chlorine	101.8 mg/dl
Creatinine	1.06 mg/dl
Urea	45 mg/dl
Rbc	5200000 células/mm3
Wbc	5240 células/mm3
Eosinophils	2%
Basophils	0%
Neutrophils	52%
Lymphocytes	38%
Monocytes	8%
Hemoglobin	15,1 gr/dl
Hematocrit	45,7%
Mcv	87.9 fl

Mchc	27 pg
CHCM	33%
Platelet count	224000 células/mm3
Glucose	79 mg/dl
C Reactive Protein	0.28 mg/dl
Procalcitonine	0.06 ng/ml
PH	7.4
PCO2	45 mmHg
PO2	85 mmHg
BE	2.4 mmol/L
Effective BE	3.1 mmol/L
BB	55.8 mmol/L

Table 2 .Discharge laboratory

CPK – MB	2,71 ng/ml
Troponine	0.054 ng/ml
Serum calcium	9.6 mg/dl
Serum magnesium	2.12 mg/dl
Serum sodium	139 mg/dl
Serum potassium	3.72 mg/dl
Serum chlorine	101.8 mg/dl
Creatinine	1.06 mg/dl
Urea	45 mg/dl
Hemoglobin	16,5 gr/dl
Hematocrit	50,4%

Discussion

The IFVT is an infrequent form of ventricular arrhythmias that occur in males between 15 and 40 years old without structural heart disease [7-8]. Although the evidence establishes a spontaneous reentry mechanism as the cause [7], it should be considered that several triggering factors may be associated, such as situations that generate high levels of catecholamines in the blood, for example the consumption of high doses of caffeine during exercise [8]. Cardiac manifestations such as atrial and ventricular arrhythmias, QT prolongation and ST-segment elevation have been reported in young patients without underlying heart disease after ED consumption [9]. Cases of Acute Atrial Fibrillation (AAF) (a rare condition in young people without structural heart disease) have been reported during sports training after ED consumption [10]. In a case series of 18 young adult patients with no known medical history who consumed ED daily, 17 cases of cardiac arrhythmias were found, 15 of them associated with concomitant intake of alcoholic beverages and other drugs 4 of them presented ST-segment elevation during arrhythmic events and another 11 presented Ventricular Arrhythmias (VA). It should be noted that in at least 2 of these cases the consumption of ED could have unmasked the presence of a channelopathy, however in most cases no cardiac anomaly was found to explain the cardiovascular events presented by the patients [6].

IFVT usually occur in patients without structural heart disease, they are sensitive to verapamil, and their mechanism is reentry using the specific conduction system of the left ventricle [7]. The most frequent are the VT that compromise the posterior fascicle, constituting 90% of the cases, this is characterized by a pattern of right bundle branch block and deviation of the axis to the left [11]. Considering the pathophysiology of IFVT, verapamil has proven to be one of the pillars of pharmacological therapy, because this drug produces a blockade of the slow channel of calcium entry in the myocardial conduction system, and it is of choice for the acute treatment of this pathology. Generally, this type of tachycardia does not respond to adenosine. Although the use of antiarrhythmic drug therapy may be helpful, radiofrequency ablation has been suggested as the treatment of choice due to its high success rate (up to 90%) with a low percentage of complications [7,11]. When evaluating a young patient without heart disease with a wide QRS tachycardia and good

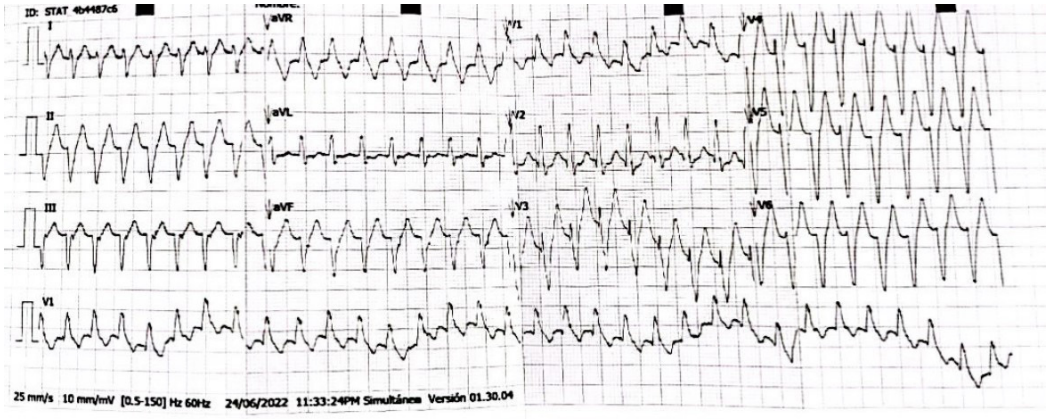

Figure 1. ECG on admission: VT QRS with morphology of incomplete right bundle branch block and axis deviated to the left.

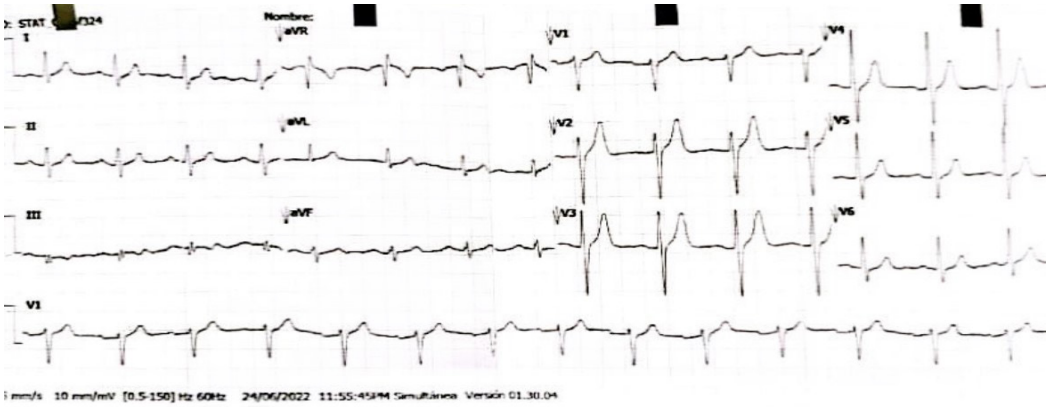

Figure 2. ECG after cardioversion with Verapamil 5 mg VEV. Sinus rhythm.

response to verapamil, it is often frequent to thought that it could be a supraventricular tachycardia with aberrant conduction, however, a careful analysis of the ECG can help us determine the presence of a IFVT when we observe atrioventricular dissociation, right bundle branch block, and left axis deviation [7]. Cases of ventricular arrhythmias and sudden death have been reported in young patients without underlying heart disease who consume energy drinks, many of these are usually associated with consumption during physical activity [2,10]. In the present case, there is a history of occasional consumption of an energy drink during exercise in the context of a young athletic patient without structural heart disease, suggesting a causal association.

Conclusion

There are several potential reasons to believe that there is an association between energy drink consumption and the occurrence of supraventricular and ventricular arrhythmias in young adult patients. Physicians must be aware of the arrhythmogenic potential of energy drinks due to their high caffeine content, which induces a rapid and sustained elevation of catecholamines. Although well-designed prospective cohort studies are needed to establish greater causality, we believe that there are sufficient data in the literature to discourage ED use in high-risk populations (coronary artery disease, cardiomyopathies, underlying arrhythmias, or hereditary channelopathy), during sports activities and in patients who have never taken caffeine, especially if they will be consumed in large quantities for short periods of time.

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