

Excess of high-caffeinated energy drinks causing ventricular arrhythmias

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ABSTRACT

A young male patient had palpitations after consumption of few high caffeinated energy drinks which he took after his office hours to relieve fatigue. He immediately sought medical help. Electrocardiogram showed multiple runs of non-sustained ventricular tachycardia and ventricular bigeminy and trigeminy. Echocardiography was normal. The patient was admitted to intensive care unit and treated with anti-arrhythmic drugs to which the arrhythmias responded and subsided. Cardiac magnetic resonance imaging of heart did not reveal any structural heart abnormality and treadmill stress test was negative ruling out significant coronary artery disease. High caffeinated energy drinks can produce serious ventricular arrhythmias if taken beyond safe doses. These ventricular arrhythmias are known to be causative factor for sudden cardiac arrest and therefore a caution & regulation is needed in widespread unrestricted use of these drinks.

Keywords: High Caffeinated Energy Drinks, Sudden death, Ventricular tachycardia

Introduction

There have been reports of sudden cardiac death after excess consumption of high-caffeinated energy drinks and use of these high-caffeinated drinks during exercise but as most of the cases did not have any medical or genetic autopsy and had delayed access to medical care, the exact cause could not be scientifically established.^[1] We describe a case of a young man who developed runs of ventricular tachycardia after taking an excess of high-caffeinated energy drinks (Sting and Ginger ale). The patient was fortunate to survive by receiving timely anti-arrhythmic therapy and documentation of ventricular arrhythmia after these drinks, as hemodynamically unstable

ventricular arrhythmias are fatal if not treated within a few minutes and this explains the incidence of sudden cardiac arrest with these drinks. To the best of our knowledge, this is the first case report for documented ventricular arrhythmia after intake of Sting (high-caffeinated energy drink) and caution needs to be applied to its casual intake among the general population.

Case History

A young male student after a stressful and overburdened day of work took a few high-caffeinated energy drinks (two bottles of Sting and Ginger ale) that evening. He immediately noticed being uncomfortable and aware of his racing heart. He immediately sought medical help, and electrocardiogram (ECG) revealed premature ventricular contractions. He was put on continuous heart rhythm monitoring which revealed runs of ventricular tachycardia [Figure 1]. His echocardiography was normal. He was managed with intravenous lignocaine and amiodarone to which the arrhythmia subsided. Cardiac magnetic resonance imaging

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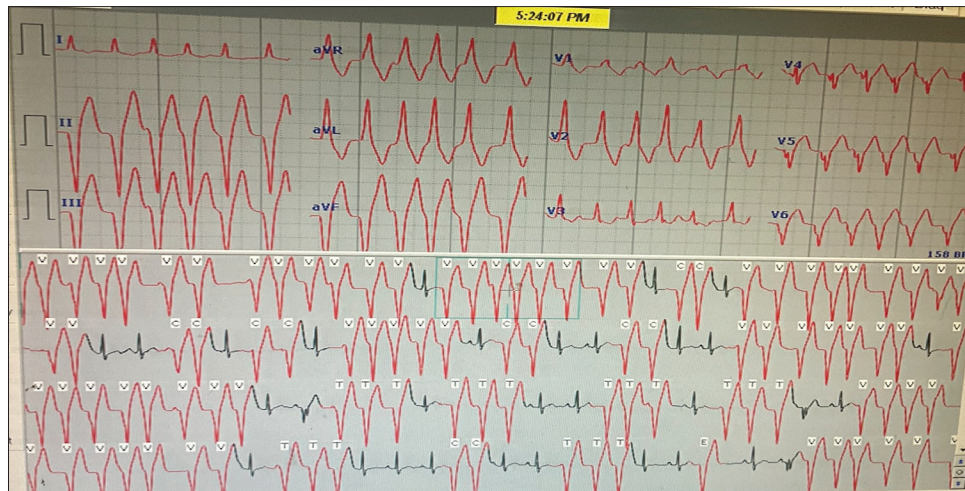


Figure 1: Runs of ventricular tachycardia on Holter recording

was normal. The treadmill stress test was negative for arrhythmias and coronary artery disease. He was discharged after a few days on oral mexiletine and amiodarone tablets. After discharge, he was followed with the continuous beat-to-beat ambulatory Holter monitoring which showed no significant ventricular arrhythmia.

Discussion

A high-caffeinated energy drink is a beverage that typically contains large amounts of caffeine, added sugars, and legal stimulants. The major constituent in most energy drinks is caffeine. They usually contain 80–150 mg of caffeine per 8 ounces with large amounts of sugar.^[1,2] Energy drinks often contain a high amount of labeled and even masked caffeine, as well as other substances, such as guarana, ginseng, and taurine in variable quantities, which may generate uncertain interactions. Guarana is a Brazilian plant containing “guaranine” which is nothing more than caffeine, in about twice the concentration of caffeine found in coffee beans (about 2–4% caffeine in guarana seeds compared with 1–2% in coffee beans).^[1] Yerba mate also contains a high caffeine concentration. Ginseng is associated with cardiovascular side effects, such as increased blood pressure (BP), long QT syndrome, or atrial fibrillation.^[1–3] Caffeine causes sympathetic activation and a rise in cytosolic calcium concentration by blocking calcium reuptake into the sarcoplasmic reticulum, which has the potential to induce arrhythmia by enhancing automaticity and after depolarization-induced triggered activity.^[4] In a murine study, the administration of 15 mg/kg per min caffeine resulted in sympathetic over-activation, with sinus tachycardia and ventricular ectopy culminating in ventricular fibrillation (VF) in all rats.^[5] Caffeine has inhibitory effects on phosphodiesterase, promoting calcium release from intracellular stores and increasing myofilament sensitivity to calcium, mimicking the effects of adrenaline.

Proarrhythmic effects may be augmented by other energy-boosting substances, such as guarana, sugar, ginseng, yohimbine, and ephedra, as well as by concurrent intake of alcohol and illicit drugs.^[4,6] These drinks also cause platelet

aggregation, rise in systolic BP, decrease endothelial cell function, and prolongation of the QTc.^[7,8] When considering body size, previous research recommends keeping caffeine intake within 3–6 mg/Kg as this is the level of intake that is ergogenic and found to be well-tolerated regardless of size and age. Children are small and a single drink may be enough to raise BP and heart rate to dangerous levels and cause serious arrhythmias and sudden death. Caffeine undergoes placental transfer which is the reason for limiting dietary intake during pregnancy. The American Academy of Pediatrics states that caffeine and other stimulating substances contained in energy drinks have no place in the diet of children and adolescents. The Food and Drug Administration (FDA) considers up to 400 mg of caffeine per day as an acceptable amount for healthy adults.^[9]

Patients with paroxysmal supraventricular tachycardia, atrial fibrillation, ventricular arrhythmia, weak heart, and cardiac channelopathies are at a high risk of lethal arrhythmias and should not consume these high-caffeinated energy drinks.

High-caffeinated energy drinks should never be taken with pre-workout supplements. As pre-workout supplement packs contain around 188 mg to 300 mg caffeine per scoop in various brands,^[10] if taken along with high-caffeinated energy drinks, the safe limit will be crossed easily.

A single can or drink can create problems in caffeine-sensitive patients. These patients report headaches, jitters, insomnia, restlessness, anxiousness, and racing heartbeat with caffeine drinks. There is a genetic component that determines how caffeine is processed in the body and variations in genes, such as CYP1A2 and ADORA2A, are associated with caffeine metabolism, sensitivity, and response.^[11]

There is serious addictive potential with these drinks. Caffeine dependence is defined using a generic set of cognitive, physiological, and behavioral symptoms, including the inability to quit, use despite harm, use more than intended, withdrawal,

and tolerance. The symptoms of caffeine withdrawal, the most common of which is headache, begin 12–24 h after the last dose of caffeine. There is an association between the heavy use of caffeine and the heavy use of alcohol.^[12]

There have been reports of sudden cardiac arrest in children and athletes after energy drinks. The window period for dangerous heart rhythm disorders, such as VF and successful detection and treatment, is extremely short. If defibrillated within the first minute of collapse, the victim's chances for survival are close to 90%. For every minute that defibrillation is delayed, survival decreases by 7% to 10%. If it is delayed by more than 10 minutes, the chance of survival in adults is less than 5%, and because of lack of public awareness and medical and genetic autopsy of these cases, most of the evidence to cause sudden cardiac death in India is missed.^[13]

The absence of regulatory oversight has resulted in aggressive marketing of energy drinks that can have dangerous health-related side effects and addiction potential. They are not for children, adolescents, or pregnant women. They should never be mixed with exercise or alcohol and is also not recommended for patients having heart rhythm problems, poor cardiac reserve, or patients on cardiac medications.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

References

- Higgins JP, Tuttle TD, Higgins CL. Energy beverages: Content and safety. *Mayo Clin Proc* 2010;85:1033-41.
- Sanchis-Gomar F, Pareja-Galeano H, Cervellin G, Lippi G, Earnest CP. Energy drink overconsumption in adolescents: Implications for arrhythmias and other cardiovascular events. *Can J Cardiol* 2015;31:572-5.
- Kaur A, Yousuf H, Ramgobin-Marshall D, Jain R, Jain R. Energy drink consumption: A rising public health issue. *Rev Cardiovasc Med* 2022;23:83.
- Voskoboinik A, Kalman JM, Kistler PM. Caffeine and arrhythmias: Time to grind the data. *JACC Clin Electrophysiol* 2018;4:425-32.
- Strubelt O, Diederich KW. Experimental treatment of the acute cardiovascular toxicity of caffeine. *J Toxicol Clin Toxicol* 1999;37:29-33.
- Ellermann C, Hakenes T, Wolfes J, Wegner FK, Willy K, Rath B, *et al*. Cardiovascular risk of energy drinks: Caffeine and taurine facilitate ventricular arrhythmias in a sensitive whole-heart model. *J Cardiovasc Electrophysiol* 2022;33:1290-7.
- Kaşıkçıoğlu E. Sports, energy drinks, and sudden cardiac death: Stimulant cardiac syndrome. *Anatol J Cardiol* 2017;17:163-4.
- Dufendach KA, Horner JM, Cannon BC, Ackerman MJ. Congenital type 1 long QT syndrome unmasked by a highly caffeinated energy drink. *Heart Rhythm* 2012;9:285-8.
- Committee on Nutrition and the Council on Sports Medicine and Fitness. Sports drinks and energy drinks for children and adolescents: Are they appropriate? *Pediatrics* 2011;127:1182-9.
- Harty PS, Zabriskie HA, Erickson JL, Molling PE, Kerksick CM, Jagim AR. Multi-ingredient pre-workout supplements, safety implications, and performance outcomes: A brief review. *J Int Soc Sports Nutr* 2018;15:41.
- Yang A, Palmer AA, de Wit H. Genetics of caffeine consumption and responses to caffeine. *Psychopharmacology* 2010;211:245-57.
- Meredith SE, Juliano LM, Hughes JR, Griffiths RR. Caffeine use disorder: A comprehensive review and research agenda. *J Caffeine Res* 2013;3:114-30.
- Ibrahim WH. Recent advances and controversies in adult cardiopulmonary resuscitation. *Postgrad Med J* 2007;83:649-54.