

Prolonged Vaping & Cannabis usage results in a Non-ST-Segment Elevation Myocardial Infarction (NSTEMI) incident in a Teenager with anxiety disorder: A case report

Jorge Pimentel ^{1,*}, Alessia Floriani ², Cesar Diaz ³, Ferdy Mendieta ⁴ and Gabriela Suero ⁵

¹ Hospiten Santo Domingo. Internal Medicine. Dominican Republic.

² Instituto Tecnológico de Santo Domingo (INTEC). Research Department. Dominican Republic.

³ Universidad Iberoamericana (UNIBE) School of Medicine. Research Department. Dominican Republic.

⁴ Hospital Metropolitano de Santiago (HOMS). Internal Medicine. Dominican Republic.

⁵ Sanitas Medical Center. Care Coach. United States of America.

World Journal of Advanced Research and Reviews, 2023, 19(03), 311–316

Publication history: Received on 30 July 2023; revised on 06 September 2023; accepted on 08 September 2023

Article DOI: <https://doi.org/10.30574/wjarr.2023.19.3.1810>

Abstract

The recreational use of nicotine vaping and cannabis among teenagers has become increasingly prevalent in recent years, raising concerns about potential health risks. This case report highlights the association between prolonged toxic habits and the occurrence of a rare but severe cardiac event known as Non-ST-segment elevation myocardial infarction (NSTEMI) in a teenage individual. A comprehensive review of the patient's medical history, including cannabis and nicotine consumption patterns and cardiovascular risk factors, was conducted. The findings indicate a strong temporal relationship between prolonged cannabis and nicotine vaping usage and the development of an NSTEMI incident in this teenager. The pathophysiological mechanisms underlying this association are discussed, including the impact of cannabis on cardiovascular function, its potential to induce arterial vasoconstriction, and its prothrombotic effects. Additionally, the role of coexisting risk factors, such as anxiety, is mentioned to elucidate their contribution to the development of NSTEMI. The implications of this case highlight the need for increased awareness among healthcare professionals, educators, and parents regarding the potential cardiovascular risks associated with prolonged cannabis usage in teenagers. Early identification of cannabis use and prompt intervention are crucial to prevent life-threatening cardiac events in susceptible individuals. Further research is warranted to explore the precise mechanisms linking cannabis use and NSTEMI incidents, enabling the development of targeted preventive strategies and evidence-based interventions to mitigate the potential harm caused by cannabis consumption in the adolescent population.

Categories: Cardiology; Emergency Medicine; Internal Medicine

Keywords: Vaping; Electronic cigarettes' e-cigarettes' vaping' e-smoking; Non-st segment elevation myocardial infarction (nSTEMI); Toxicology; teenage; Marijuana; Cannabis; stemi; Myocardial infarction

1. Introduction

Cannabis, a widely used psychoactive substance, has gained increasing attention due to its potential health effects. While the limited medical and recreational use of cannabis continues to be a subject of debate, evidence linking cannabis consumption to cardiovascular complications is emerging. In recent years, the use of cannabis has become increasingly prevalent, with varying degrees of legality and social acceptance in different regions. As attitudes toward cannabis change, it is crucial to examine its potential health effects, especially in vulnerable populations such as teenagers. Mounting evidence suggests that cannabis use may be associated with cardiovascular complications, including

* Corresponding author: Jorge Pimentel.

myocardial infarction (MI). Although the majority of studies focus on adult populations, there is a growing concern about the impact of cannabis use on the cardiovascular health of adolescents [1]. On the other hand, vaping and electronic cigarettes have also demonstrated a concerning rise in cardiovascular events among young individuals [2].

Cannabis is derived from the *Cannabis sativa* plant and contains numerous chemical compounds, including tetrahydrocannabinol (THC) and cannabidiol (CBD), which exert psychoactive and therapeutic effects. The prevalence of cannabis use has increased in recent years, with estimates suggesting that a significant percentage of adolescents experiment with or regularly consume cannabis [3]. Understanding the patterns of cannabis use, including frequency, duration, and modes of consumption, is vital for assessing its potential health risks. Emerging evidence suggests a link between cannabis use and cardiovascular complications. Several case reports and observational studies have reported associations between cannabis use and adverse cardiovascular events, including myocardial infarction, arrhythmias, and sudden cardiac death. However, the mechanisms underlying these associations are not yet fully understood, and further research is needed to elucidate the complex interplay between cannabis use and cardiovascular health [4].

A survey among adolescent groups revealed that about three-fourths of adolescents thought there was no significant harm in cannabis usage [1]. Furthermore, a longitudinal study showed that black youths use it more compared to whites [5]. Vaping of marijuana has gained recent popularity, especially among high school students. It was believed earlier that vaping was safer than smoking because of no carbon monoxide component from heating. It also produced increased blood THC level and psychoactive effect, but recent reports say it causes more damage to the lungs [6].

2. Case Presentation

We'll go over the case of a 17-year-old male who arrived at the Emergency Department (ED) with his parents at 3 am with excruciating chest pain, paleness of the skin, and excessive sweating. The pain started suddenly while he was sleeping, rated at the maximum intensity of 10/10 on the pain scale, nonradiated with a duration of about 15 minutes. He expressed that he had never felt similar pain before and hadn't taken any medications for it.

The past medical history includes a period of two years dealing with depression and anxiety for which he has been treated with sertraline 100mg and bupropion 150mg once daily. He denies past or current use of recreational drugs or toxic habits. Notably, there is a family history of hypertension in the mother and type 2 diabetes mellitus (DM2) in the father.

Upon physical examination, the patient was alert and oriented with an unusual lightness of the skin color, was diaphoretic while normothermic, and experienced nausea without vomiting. No murmurs, gallops, or rubs were present on auscultation, but his vital signs raised concern as evidenced by a blood pressure reading of 170/110mmHg, a heart rate of 103 bpm, and an oxygen saturation level of 92%. Prompt stabilization had been achieved with 0.9% saline solution and enantyum (dexketoprofen) administration, followed by an electrocardiogram (EKG) as indicated by the chest pain protocol. The EKG displayed ST segment depressions in leads II, III, and AVF, consistent with an acute NSTEMI (figure 1).

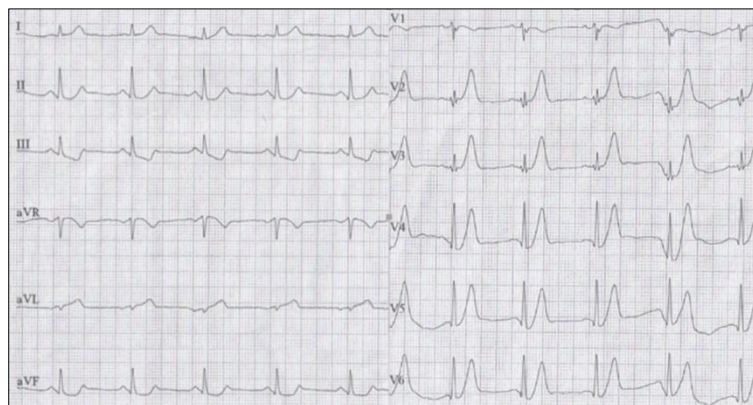


Figure 1 EKG displayed ST segment depressions in leads II, III, and AVF

Immediate intervention involved morphine administration as pain management wasn't achieved with dexketoprofen, oxygen via simple face mask at 10 L/min, sublingual nitroglycerin, and aspirin, followed by transfer to the catheterization lab for revascularization by percutaneous coronary intervention (PCI). However, coronary angiography showed no evidence of obstruction in either coronary artery or its branches, with both demonstrating unimpeded blood flow. Figure 2 displays the presented results.

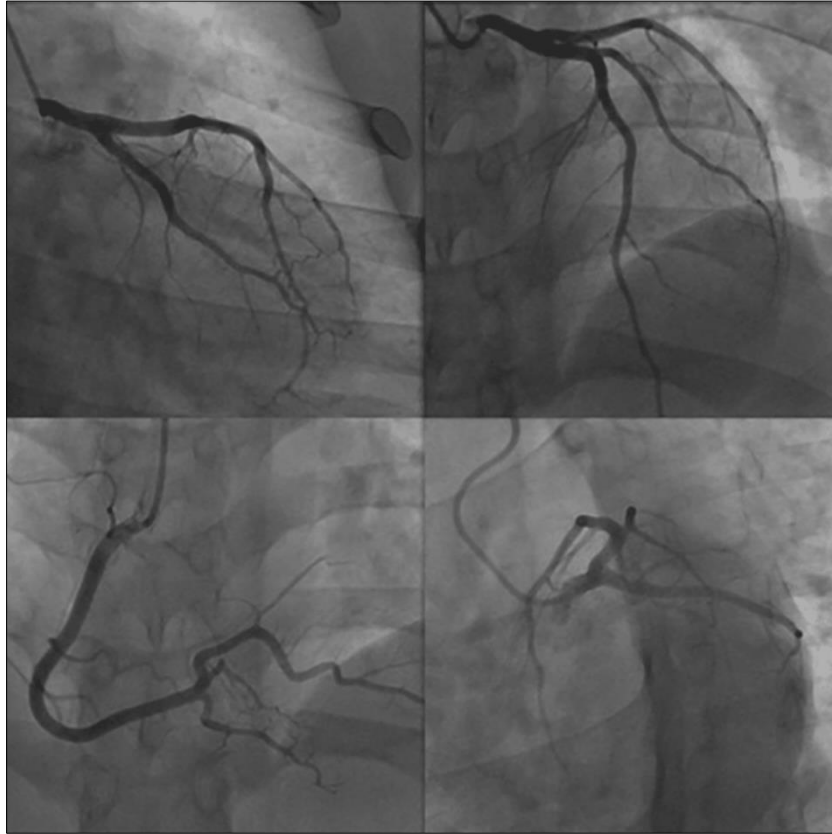


Figure 2 Coronary Angiography Showing Normal Patency of Coronary Vessels

Despite the negative angiography results, the patient's symptoms improved and was further admitted for an overnight observation. Within 24 hours of admission, in reassessment of the patient, vital signs and appearance are improved. He seems uneasy thinking that this episode can happen again and admits the use of daily electronic cigarettes, consuming an average of 100-140 puffs per day, and marijuana use in the form of 2 blunts (1 gram each) daily for the past year, previously consuming 1 blunt the day before the chest pain episode.

This additional evidence raises the possibility that the chest pain episode may have been related to a transient coronary vasospasm induced by combined nicotine and marijuana use. Cardiac enzyme levels taken upon admission results revealed data suggestive of myocardial injury (table 1).

Table 1 Laboratory value taken after 2 hours of symptoms onset

Laboratory Study	Level	Normal Range
Troponin-I	5.2 ng / mL	0-0.04 ng/mL

3. Discussion

The widespread legalization and changing societal attitudes towards cannabis have ignited a global dialogue about its potential impact on public health. As the landscape of cannabis use continues to evolve, so does our understanding of its effects on various organ systems, including the cardiovascular system. Among the growing concerns is the potential correlation between cannabis use and myocardial infarctions.

The term myocardial injury should be used when there is evidence of elevated cardiac troponin values (cTn) with at least 1 value above the 99th percentile in the upper reference limit. Criteria for myocardial infarction should be used when there's evidence of acute myocardial injury, plus 1 of the following: symptoms of myocardial infarction, new ischemic ECG changes, development of pathological Q waves, imaging evidence of new loss of viable myocardium or wall motion abnormality and identification of a coronary thrombus by angiography [7]. Vasospasms can contribute to myocardial infarction due to their ability to cause the temporary constriction or narrowing of the coronary arteries. The coronary arteries are responsible for supplying oxygen and nutrients to the heart muscle. When a vasospasm occurs in one of these arteries, it can restrict blood flow to the heart, leading to a reduction in oxygen delivery. Up-sloping ST-segment depression in leads I and AVL with positive T waves is increasingly recognized as a sign of regional subendocardial ischemia associated with severe obstruction of the left anterior descending coronary artery [8]. Chest pain, which is often described as chest pressure, tightness, or a squeezing sensation, is the most frequent symptom in patients presenting with acute myocardial infarction [9]. It is worth highlighting that despite drug-induced AMI being not a common event, attention to smoking and drugs in teenagers and young adults will have major therapeutic and prognostic implications [10]. Myocardial infarction (MI) among young adults (<45 years) represents a considerable proportion of the total heart attack incidents, but in younger patients' multiple cases of myocardial infarction have also been seen most of them being caused by the abuse of cannabis, which is the most frequently abused substance. It has been linked with incident MI independently of traditional cardiovascular risk factors, with the effect being more pronounced in younger patients [11]. Our case report presents a compelling instance of a patient who experienced a myocardial infarction, characterized by intense chest pain, accompanied by symptoms of nausea and paleness. The individual had a prior medical history of depression and anxiety, for which he received treatment with sertraline and bupropion. Notably, the ECG findings displayed ST segment depressions in leads II, III, and AVF, consistent with a right coronary ST myocardial infarction. The ECG is the most frequently used test in clinical cardiology. It is critical for evidence-based management of patients with most cardiovascular conditions, including patients with acute myocardial infarction [10,11].

Of particular interest in this case, the patient revealed his regular usage of electronic cigarettes. Additionally, he admitted to using cannabis twice daily for a duration of one year. Furthermore, confessing to naturally smoking cannabis on the very day the myocardial infarction occurred. Being this the most commonly used drug of abuse by adolescents in the world. The high prevalence of adolescents consuming cannabis generates a large number of young people who could develop depression and suicidality attributable to cannabis [12]. The composition of marijuana (THC-cannabinoid ratio, terpenoids) can influence its therapeutic and cardiovascular adverse effects, with cannabis smoke being as harmful as tobacco smoke [13].

In a groundbreaking cohort study conducted by Justin Ley and his esteemed colleagues, a remarkable discovery came to light. The research focused on 10 case subjects who presented with chest pain, coupled with EKG evidence indicative of ST-elevation myocardial infarction (STEMI), all of whom reported cannabis use. Remarkably, the mean age at presentation for these individuals was 40 years old, signifying a noteworthy finding - they were, on average, 10 years younger than the control group, which comprised individuals with no history of marijuana use [14]. A number of studies have attempted to characterize the hemodynamic effects of cannabis use as well as its potential negative impact on the cardiovascular system, but the data are inconclusive at this time [15].

Cannabis consumption has been shown to cause arrhythmia including ventricular tachycardia, and potentially sudden death, and to increase the risk of myocardial infarction (MI). These effects appear to be compounded by cigarette smoking and precipitated by excessive physical activity, especially during the first few hours of consumption. Cannabinoids, or the active compounds of cannabis, have been shown to have heterogeneous effects on central and peripheral circulation [16].

Once the patient is stabilized, medications are administered to reduce the workload on the heart, lower blood pressure, and prevent the formation of new clots. Additionally, therapies are implemented to manage other risk factors such as diabetes, hypertension, and high cholesterol. In contrast to oxygen, the use of morphine has a very pivotal rationale in myocardial infarction: to alleviate the chest pain that for some patients is totally unbearable [17]. Aspirin's antithrombotic effects have a long-established place in the prevention of cardiovascular disease (CVD), and its traditional use as a core therapy for secondary prevention of CVD is well recognized [18].

Our case report highlights the potential relationship between cannabis consumption and early-onset myocardial infarctions, especially when combined with electronic cigarette use. Studies have suggested that cannabis consumption may increase the risk of cardiovascular events, including myocardial infarction. While the exact mechanisms are not fully understood, it is believed that cannabis can lead to hemodynamic changes, vasospasm, and pro-inflammatory effects, all of which may contribute to the development of heart attacks. Furthermore, emphasizing the significance of

early detection, appropriate medication administration, and swift response is paramount in preserving heart function and mitigating complications.

4. Conclusion

The findings discussed in the case show a relationship between combined cannabis and electronic cigarette use and the myocardial infarction episode in a young patient. Although the coronary angiography did not reveal significant obstructions in the coronary arteries, the patient exhibited typical symptoms of acute myocardial infarction, and cardiac enzyme levels confirmed myocardial damage. The subsequent admission by the patient regarding his regular use of electronic cigarettes and cannabis provided a crucial clue to the possible cause of the episode: transient coronary vasospasm induced by the combination of nicotine and cannabis. This highlights the importance of considering unconventional risk factors and the need to inquire about substance use in young patients with cardiac symptoms, especially when traditional risk factors are not evident.

A general recommendation to address this issue is to promote greater awareness among healthcare professionals and the public about the potential risks of cannabis and electronic cigarette use, especially in young individuals. Physicians should systematically inquire about substance use in patients and be alert to possible cardiovascular effects. Additionally, young individuals should be encouraged to refrain from using these substances or seek help to quit if they are already consuming them. Education about the potential risks and health consequences, especially in the cardiovascular context, can help prevent future cases of infarctions associated with cannabis and electronic cigarette use in the young population.

Compliance with ethical standards

Disclosure of conflict of interest

All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work.

Financial support

All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.

Statement of informed consent

Consent was obtained or waived by all participants in this study. Universidad Iberoamericana (UNIBE) IRB #2 - Health and Behavioral Sciences issued approval IRB00012142.

References

- [1] Banerjee A, Gandhi AB, Antony I, et al.: Role of Cannabis in the Incidence of Myocardial Infarction: A Review. *Cureus*. 2020, 22:11097. [10.7759/cureus.11097](https://doi.org/10.7759/cureus.11097)
- [2] Alzahrani T, Pena I, Temesgen N, et al.: Association Between Electronic Cigarette Use and Myocardial Infarction. *Am J Prev Med*. 2018, 55:455-461. [10.1016/j.amepre.2018.05.004](https://doi.org/10.1016/j.amepre.2018.05.004). Epub 2018 Aug 22. Erratum in: *Am*
- [3] Wilson J, Freeman TP, Mackie CJ: Effects of increasing cannabis potency on adolescent health. *Lancet Child Adolesc Health*. 2019, 3:121-128. [10.1016/S2352-4642\(18\)30342-0](https://doi.org/10.1016/S2352-4642(18)30342-0)
- [4] Lee J, Sharma N, Kazi F, et al.: Cannabis and Myocardial Infarction: Risk Factors and Pathogenetic Insights. *Scifed J Cardiol*. 201711, 1000004.
- [5] Gobbi G, Atkin T, Zytynski T, et al.: Association of Cannabis Use in Adolescence and Risk of Depression, Anxiety, and Suicidality in Young Adulthood: A Systematic Review and Meta-analysis. *JAMA Psychiatry*. 2019, 76:426-434. [10.1001/jamapsychiatry.2018.4500](https://doi.org/10.1001/jamapsychiatry.2018.4500)

- [6] Singh C, Rao K, Yadav N, et al.: Current Cannabidiol Safety: A Review. *Curr Drug Saf.* 2023, 18:465-473. 10.2174/1574886317666220902100511
- [7] Thygesen K, Alpert JS, Jaffe AS, et al.: Executive Group on behalf of the Joint European Society of Cardiology (ESC)/American College of Cardiology (ACC)/American Heart Association (AHA)/World Heart Federation (WHF) Task Force for the Universal Definition of Myocardial Infarction. Fourth Universal Definition of Myocardial Infarction (2018). *J Am Coll Cardiol.* 2018, 30:2231-2264. 10.1016/j.jacc.2018.08.1038
- [8] Birnbaum Y, Wilson JM, Fiol M, et al.: ECG diagnosis and classification of acute coronary syndromes. *Ann Noninvasive Electrocardiol.* 2014, 19:4-14. 10.1111/anec.12130
- [9] Ladha KS, Mistry N, Wijeyesundera DN, Clarke H, Verma S, Hare GMT, Mazer CD: Recent cannabis use and myocardial infarction in young adults: a cross-sectional study. *CMAJ.* 2021, 7:1377-1384. 10.1503/cmaj.202392.
- [10] El Menyayir AA: Drug-induced myocardial infarction secondary to coronary artery spasm in teenagers and young adults. *J Postgrad Med.* 2006, 52:51-6.
- [11] Richter JS, Quenardelle V, Rouyer O, Raul JS, Beaujeux R, Gény B, Wolff V: A Systematic Review of the Complex Effects of Cannabinoids on Cerebral and Peripheral Circulation in Animal Models. *Front Physiol.* 2018, 29:622. 10.3389/fphys.2018.00622
- [12] Roguin A, Kobo O, Meisel SR, et al.: *J Cardiovasc Pharmacol Ther.* 2022, 27:10742484221107793. 10.1177/10742484221107793
- [13] Pacher P, Steffens S, Haskó G, Schindler TH, Kunos G: Cardiovascular effects of marijuana and synthetic cannabinoids: the good, the bad, and the ugly. *Nat Rev Cardiol.* 2018, 15:151-166. 10.1038/nrcardio.2017.130. Epub 2017 Sep 14
- [14] Lee J, Sharma N, Aponte CS, et al.: Clinical Characteristics and Angiographic Findings of Myocardial Infarction among Marijuana Users and Non-Users. *Scifed J Cardiol.* 2017:1.
- [15] Ghosh M, Naderi S: Cannabis and Cardiovascular Disease. *Curr Atheroscler Rep.* 2019, 12:21. 10.1007/s11883-019-0783-9
- [16] Goyal H, Awad HH, Ghali JK: Role of cannabis in cardiovascular disorders. *J Thorac Dis.* 2017, 9:2079-2092. 10.21037/jtd.2017.06.104
- [17] Atar D, Agewall S: Morphine in myocardial infarction: balancing on the tight rope. *Eur Heart J.* 2016, 14:253-5. 10.1093/eurheartj/ehv546
- [18] Murphy E, Curneen JMG, McEvoy JW: Aspirin in the Modern Era of Cardiovascular Disease Prevention. *Methodist Debaquey Cardiovasc J.* 2021, 24:36-47. 10.14797/mdcvj.293