



Interaction of cannabis cultural use and health: A case of acute myocardial infarction following consumption of cannabis beverage (Bhang)

Barun Kumar^{a,*}, Omna Chawla^b, Abhimanyu Nigam^a, Pankaj Kumar Singh^c, Anupam Singh^d

^a Department of Cardiology, AIIMS Rishikesh, Uttarakhand, India

^b Department of Physiology, Government Medical College, Haridwar, Uttarakhand, India

^c Department of Cardiology, AIIMS Rishikesh, Uttarakhand, India

^d Department of Ophthalmology, AIIMS Rishikesh, Uttarakhand, India

ARTICLE INFO

Keywords:

Cannabis
Recreational
Anterior wall MI
Bhang
Cannabis Beverage

ABSTRACT

Cannabis is a psychoactive substance consumed worldwide in the form of smoking, vapors, food additives, or beverages. Delta 9 tetrahydrocannabinol (THC) is a primary component responsible for short and long-term effects on various cognitive and motor functions in a dose-dependent manner. The legal status of cannabis has shifted significantly in recent decades. Some regions maintain strict penalties, but others have legalized them for medicinal use. In India, the use of cannabis in any form is illegal; however, the use of bhang, a cannabis beverage made from leaves, is acceptable due to cultural reasons and thus permitted in some places. We report the case of a 28-year-old male who developed massive anterior wall myocardial infarction after consuming bhang during the Holi festival. He presented with sudden retrosternal chest pain, which was initially ignored till it intensified enough, prompting him to seek emergency medical help approximately 24 hours after symptom onset. Cannabis intoxication impaired attention and information processing, leading to delayed presentation. The patient was managed successfully by timely cardiac intervention. The evolving landscape of cannabis regulations necessitates heightened awareness among health authorities about potential cardiovascular risks associated with its consumption, particularly in forms like Bhang, where concentrations are unregulated and variable.

1. Introduction

Cannabis (or marijuana) is a commonly used psychoactive substance with over 200 million users worldwide [1]. Cannabis consumption varies from smoking, vapors, food additives, or beverages. The primary component is Delta-9-tetrahydrocannabinol (THC), which is responsible for an array of short and long-term effects influencing various cognitive and motor functions in a dose-dependent manner. Its use is associated with multiple psychosocial and health implications and thus has always been under the radar of health monitoring authorities. However, the legal landscape regarding cannabis has changed dramatically in recent decades. Some regions continue to penalize the sale, and use of cannabis, whereas others have legalized it due to its medicinal properties. In India, possessing and using various forms of cannabis is unlawful; however, Bhang is the only preparation of cannabis that is not covered in this act and is permitted due to some socio-cultural sanctions. It is a beverage made from an infusion of cannabis leaves, which is believed to be a less

harmful form and is also the least studied preparation [2].

Myocardial infarction in young men less than 40 years of age is associated with various risk factors like smoking, hypertension, high TG, and low HDL. Anterior wall MI (AMI) is more common, and most patients have a single-vessel disease [3]. Though there are few reported cases of cannabis smoking-induced AMI, still there is a lack of literature concerning the use of cannabis beverages (popularly known as Bhang).

The restriction on cannabis use is continuously changing [4], and thus, there is a need to report such cases with the possibility of further exploration.

2. Case

This is a 28-year-old male who traveled from his native city to a remote place for recreational activities during the festival of Holi. He presented to us with a sudden onset of retrosternal chest pain. At the beginning of the symptoms, he had ignored the pain, which worsened

* Correspondence to: Department of Cardiology, AIIMS, Rishikesh, Uttarakhand 249203, India.

E-mail addresses: drbarun79@gmail.com (B. Kumar), omnachawla@gmail.com (O. Chawla), ab.nigam31@gmail.com (A. Nigam), pks.kumarsingh222@gmail.com (P.K. Singh), dr.anupamsingh@gmail.com (A. Singh).

<https://doi.org/10.1016/j.toxrep.2024.101755>

Received 15 June 2024; Received in revised form 29 September 2024; Accepted 30 September 2024

Available online 1 October 2024

2214-7500/© 2024 Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

over a few hours, and thus reported to the emergency department approximately 24 hours after the onset of symptoms. The Patient was diaphoretic, though alert and oriented to person, place, time, and situation. He admitted smoking cigarettes (1 or 2 per day) for the last six years and the occasional intake of alcohol. He denied any use of illicit or injectable drugs. He had no significant medical or surgical history. He did not have a family history of medical problems, did not have allergies, and did not take any medications. On further exploration, it was found that he had consumed large quantities of Bhang (cannabis) and alcohol during the Holi festival celebrations. The onset of these symptoms was associated with the consumption of Bhang.

At the time of admission, the patient was in severe pain and dyspnea. On examination, he had tachycardia (pulse-rate was 130 beats/min, regular and low volume), tachypnoea (42/min), and blood pressure was 100/70 mm Hg. The random blood sugar was 159 mg/dL, and oxygen saturation on room air was 82 %. The chest examination showed extensive bilateral crepitations and wheezes. An electrocardiogram (Fig. 1) showed the presence of poor R-wave progression in precordial leads from V1-V6, with ST-segment elevations in V3-V6 and T inversions, which was suggestive of evolved anterior wall myocardial infarction.

The Cardiology team assessed the patient. His echocardiogram done in the emergency department showed hypokinesia of the basal-, and mid- anterior, antero-septal, and anterolateral wall; the apex was hypokinetic, and left ventricular ejection fraction was 30–35 %. The patient was diagnosed with acute anterior wall ST-elevation myocardial infarction, with a window period of 24 hours, with acute left ventricular

failure, in Killip Class III.

He was immediately shifted to the cardiac cath lab for primary percutaneous coronary intervention (PCI). The patient was given loading doses of Tab. Aspirin 300 mg, Tab. Ticagrelor 180 mg, T. Atorvastatin 80 mg and taken for coronary angiography and PCI. The angiogram revealed thrombotic occlusion of both mid-left anterior descending artery (LAD) and proximal major obtuse marginal-1 (Red arrow indicating the site of blockage), with a normal right coronary artery (Fig. 2).

Immediately, primary percutaneous transluminal coronary angioplasty (PTCA) was performed with thrombosuction for both LAD and proximal major obtuse marginal-1, due to extensive thrombus burden and slow coronary flow (TIMI II flow). After thrombosuction, stenting was done to proximal major obtuse marginal-1 using two drug-eluting stents and mid LAD using one drug-eluting stent (Video 1, Video 2 A, and 2B). Then, he was shifted to the intensive coronary care unit (ICCU) for further management.

In ICCU, subsequently, his blood investigations revealed elevated high-sensitivity C-reactive protein (hs-CRP) of 153 mg/L, total cholesterol levels of 190 mg/dL, serum triglycerides of 217 mg/dL, and LDL cholesterol levels of 126 mg/dL. For the rest of other investigations, CBC, LFT, KFT, HbA1C were within normal limits. He was managed for acute left ventricular failure over the next two days. He showed improvement and gradually weaned off from non-invasive ventilation (CPAP support), and later on, he weaned off oxygen support and continued stabilization with medical management. The patient then developed complaints of chest uneasiness, and his monitor showed

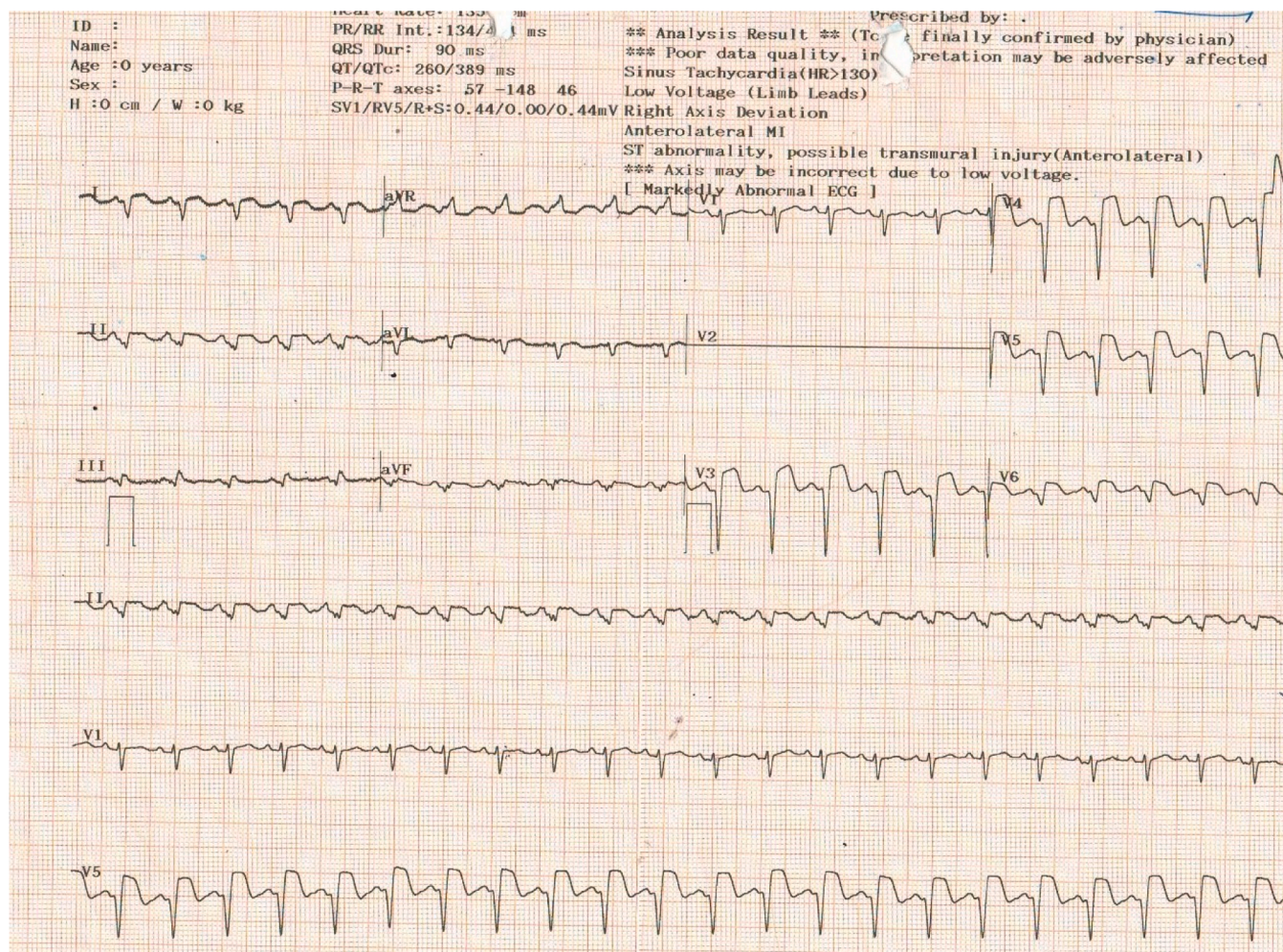


Fig. 1. Standard 12 limb lead ECG, showing Poor precordial R wave Progression from V1-V6, ST segment elevations in V3-V6, I and aVL.

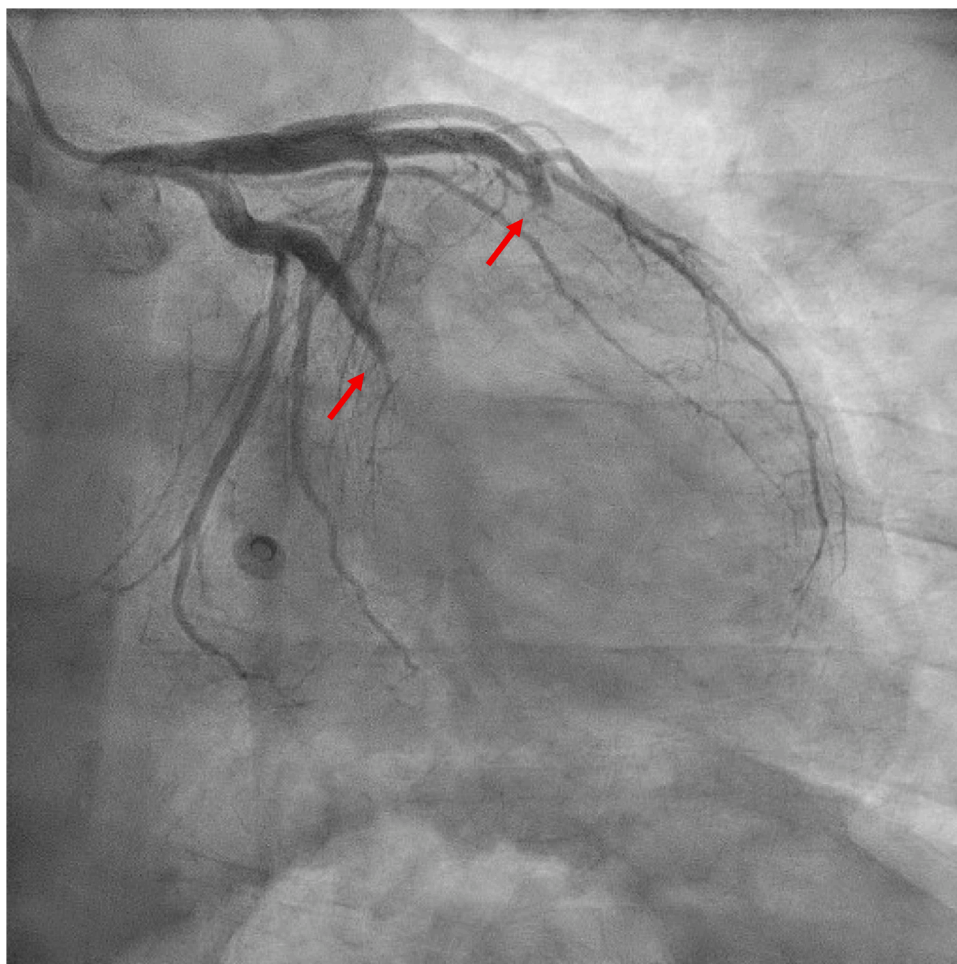


Fig. 2. Cine-angiographic image, taken in right anterior oblique with caudal projection (RAO caudal view), showing contrast opacification of the left main coronary artery, left anterior descending and left circumflex coronary artery, with 100 % occlusion of the mid- left anterior descending artery and proximal major obtuse marginal-1 (red arrow indicating the site of blockage).

sustained monomorphic ventricular tachycardia (Fig. 3), which was hemodynamically stable.

He was given a loading dose of an intravenous injection of Amiodarone and an intravenous injection of Lignocaine, but his ventricular tachycardia (VT) did not revert. Then, he was given synchronized DC cardioversion with 200 joules, and VT was reverted to sinus rhythm. His blood investigations showed the presence of hypokalemia, which was managed with intravenous potassium replacement and later oral potassium supplements. The Patient improved and maintained sinus rhythm over the course of the next three days and was discharged in stable condition.

3. Discussion

Though cannabis-induced cardiovascular events are frequently reported, most reports follow inhaled, smoked, or vaporised forms of cannabis, especially in chronic drug abusers [5]. Here, we report an unexpected event where the young man consumed Bhang as a recreational activity. This beverage is prepared using dried mature leaves of the Cannabis sativa plant, the Indian hemp plant, which grows in most parts of the world.

Delta-9-tetrahydrocannabinol (delta-9-THC, Fig. 4), the predominant form of THC in cannabis, possesses a dibenzopyran ring structure. The double bond at the 9th position in the pyran ring is essential for interaction with cannabinoid receptors (CB1 and CB2) widely distributed through the human body, including regions of the central and

peripheral nervous systems, immune cells, and platelets. These are associated with the Gi protein, an inhibitory GTP-binding protein-coupled receptor. These are triggered by an agonist such as THC, inhibiting adenylyl cyclase (AC), decreasing intracellular cAMP levels, and ultimately facilitating platelet aggregation and activation.

Thrombosis occurs due to alterations in blood coagulability inside the coronary arteries, potentially resulting in myocardial infarction. Platelets, which facilitate coagulation, play a central role in this process. Cannabinoid receptors (CB1R and CB2) are expressed, which are activated by cannabis compounds (delta-9-THC), resulting in heightened platelet activation and aggregation, hence elevating the risk of thrombosis. Cannabis may induce inflammation in blood vessels, resulting in endothelial dysfunction and promoting platelet activation and thrombus formation. Moreover, cannabis consumption may cause vasoconstriction, so diminishing blood supply to the cardiac muscle and heightening the likelihood of a cardiac incident [6,7].

On the other hand, alcohol exhibits a multifaceted association with cardiovascular health. Moderate alcohol intake exhibits anti-inflammatory properties and promotes cardiovascular health. Excessive alcohol consumption disrupts the body's standard coagulation mechanism, resulting in a hypercoagulable condition and enhancing the risk of thrombosis [8].

The simultaneous consumption of alcohol and cannabis exacerbates the associated risks. Individuals who concurrently use both typically exhibit elevated alcohol consumption, hence intensifying the corresponding hazards. Moderate alcohol consumption reduces platelet

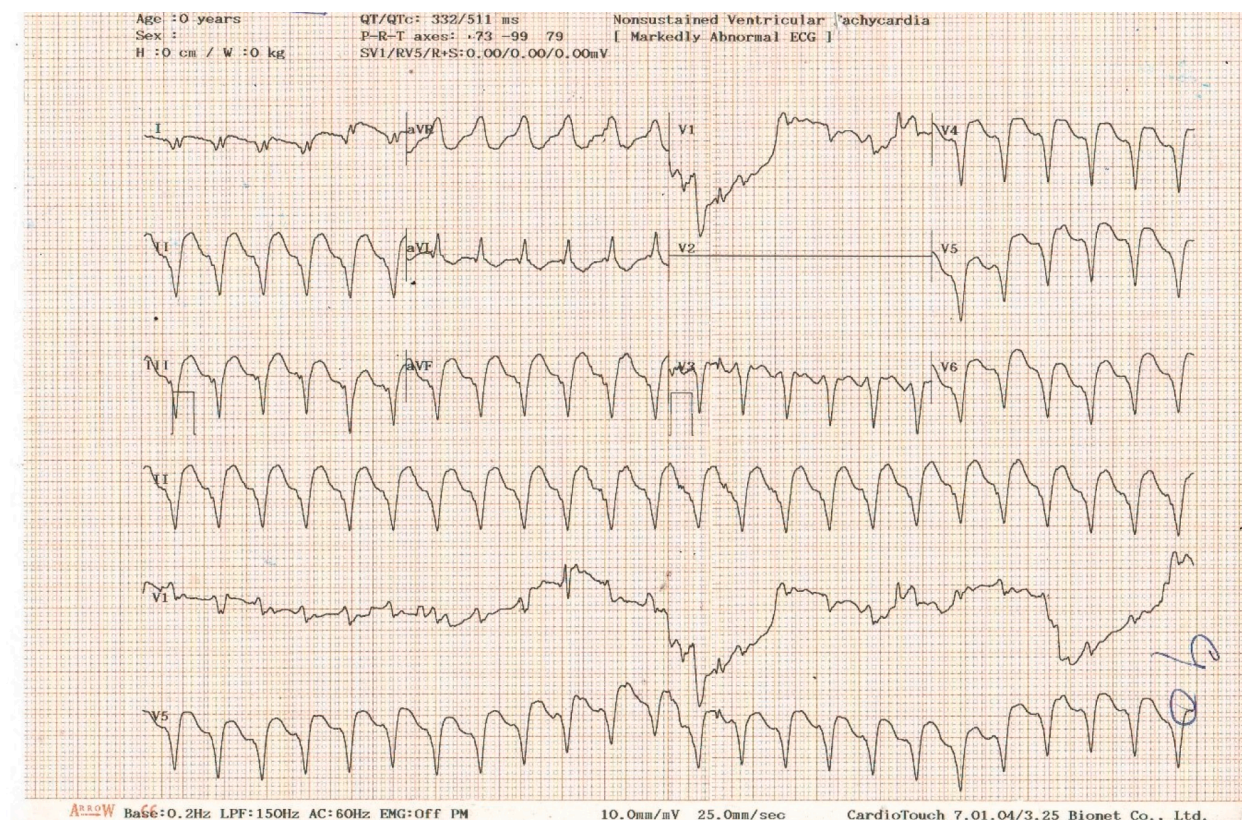


Fig. 3. Standard 12-lead ECG, showing regular wide complex tachycardia (QRS width: 160 msec) at a heart rate of 160/min, suggestive of ventricular tachycardia.

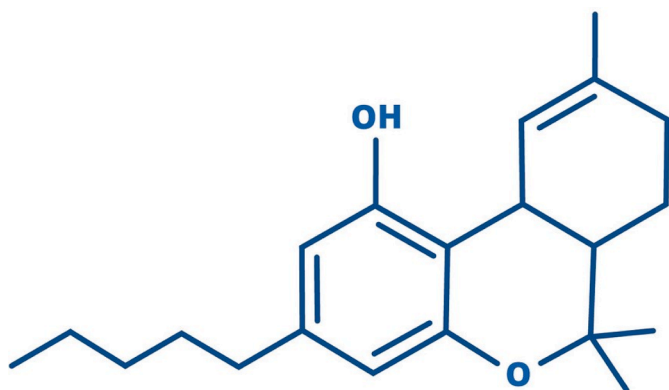


Fig. 4. Structure of delta-9-tetrahydrocannabinol.

reactivity, whereas binge drinking elevates thromboxane levels, resulting in platelet hyperaggregation [9]. The synergistic effect of enhanced clotting potential from cannabis and alcohol can markedly elevate the risk of coronary thrombosis and subsequent cardiovascular incidents (Fig. 5).

Recreational use involves untitrated concentrations, and intoxication is known to impair processing speed, cognition, and psychomotor abilities when used in higher doses. There is no method of quality control of these products [10]. The biological properties of cannabis are related to cannabinoids that depend on their interactions with G protein-coupled cannabinoid receptors, CB1 and CB2. THC is a partial agonist of both CB1 and CB2 receptors but has a higher affinity for the CB1 receptor, which appears to mediate its psychoactive properties. The CB1 receptors are in the CNS, immune cells, gastrointestinal, reproductive, adrenal, heart, lung, and bladder tissues. The CB2 receptors are thought to have

immunomodulatory effects and to regulate cytokine activity. THC has anti-inflammatory, anti-cancer, analgesic, muscle relaxant, and neuro-antioxidative properties. It has also been associated with anxiety, cholinergic deficits, and immunosuppression [11]. There is autonomic dysregulation with alteration in coronary microcirculation, which acts to cause deleterious clinical events rather than any sole mechanism [12]. In this case, the young man, despite lacking conventional cardiovascular risk factors, experienced acute myocardial injury, possibly due to a THC-induced thrombotic event and coronary vasospasm aggravated by concurrent alcohol consumption. [13]. One of the notable challenges in this scenario was the delayed recognition of symptoms due to misinterpretation. Cannabis intoxication can impair attention and information processing, especially in occasional users, leading to delayed medical attention when symptoms such as chest pain manifest. This delay emphasizes the importance of thorough history-taking regarding substance use, especially in young patients presenting with chest pain [14–16].

Since the above-discussed case involves a cannabis user consuming it at a festival, the reported symptoms and the perceived need for medical assistance were delayed for a significant duration.

Secondly, young AMI usually presents as a single-vessel disease [3]. The double-vessel coronary involvement with more extensive MI in a young man can be supported by recent literature that suggests that recreational drugs-induced MI has more severe presentations in <50-year-old patients. Therefore, this kind of AMI is a serious event that requires prompt diagnosis and management to prevent complications and mortality.

Furthermore, the evolving landscape of cannabis regulations necessitates heightened awareness among health authorities about potential cardiovascular risks associated with its consumption, particularly in forms like Bhang, where concentrations are unregulated and variable.

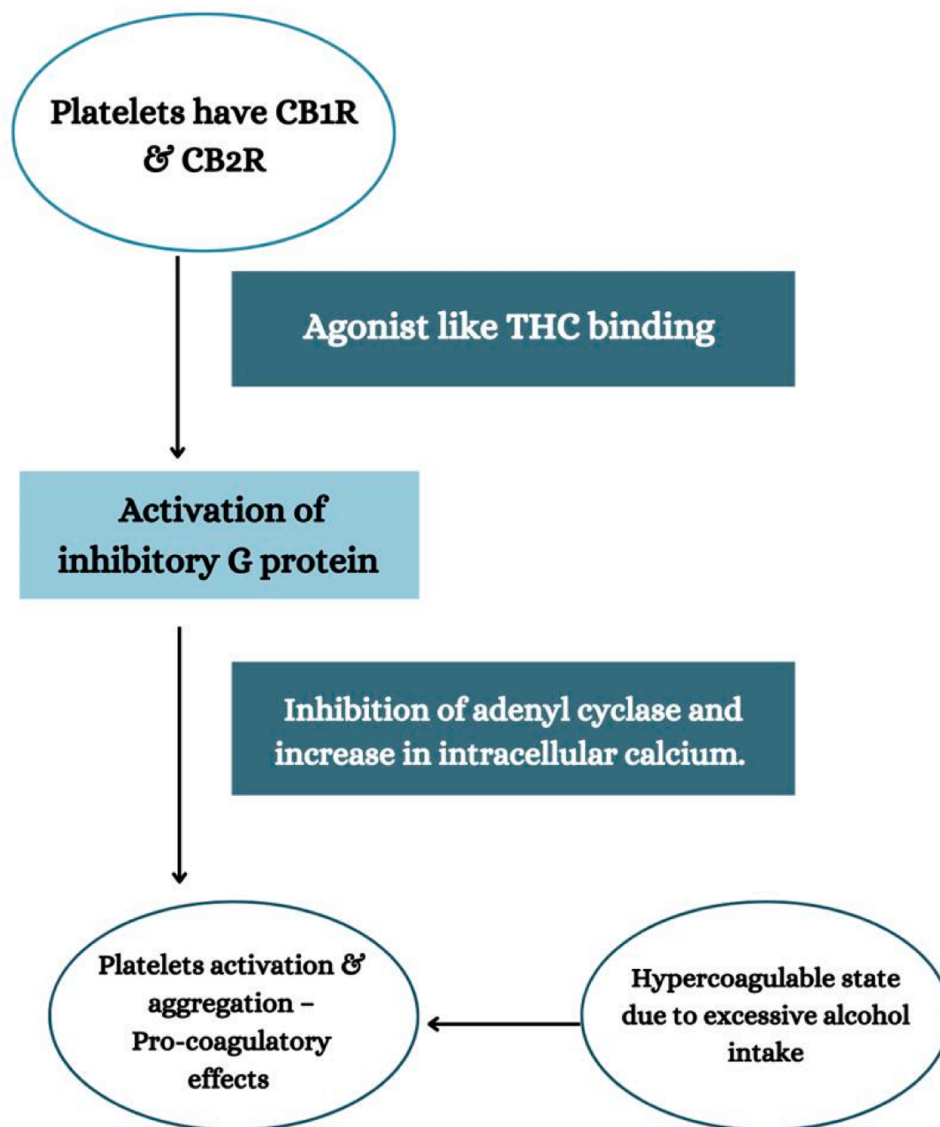


Fig. 5. Flow chart of the pathophysiology of hypercoagulable state due to cannabis-alcohol co-use.

4. Conclusion

A young male developed acute myocardial infarction after cannabis beverage consumption while he had no other conventional cardiovascular risk factors. The reporting of symptoms was delayed due to misinterpretation of symptoms as psychotomimetic effects of cannabis. This case serves as a poignant reminder of the diverse and potentially serious cardiovascular effects of cannabis, especially in less experienced users consuming high concentrations during festive occasions. It emphasizes the critical need for early recognition of symptoms and tailored management strategies to mitigate complications and improve outcomes in similar clinical presentations.

Learning Points

- A cautious history of substance abuse should be thoroughly sought in young patients who present with chest pain. High levels of intoxication may lead to a delay in recognition of symptoms.
- Although cannabis consumption rules are changing, health officials should still be more cautious because of potentially dangerous outcomes.

Funding

This research did not receive any kind of funding from public or commercial firms.

CRediT authorship contribution statement

Pankaj Kumar Singh: Writing – review & editing, Software, Formal analysis, Data curation. **Abhimanyu Nigam:** Writing – original draft, Software, Formal analysis, Data curation. **Omna Chawla:** Writing – review & editing, Writing – original draft, Validation, Data curation, Conceptualization. **Barun Kumar:** Writing – review & editing, Writing – original draft, Validation, Software, Methodology, Investigation, Data curation, Conceptualization. **Anupam Singh:** Writing – review & editing, Writing – original draft, Software, Resources, Data curation.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Barun Kumar reports was provided by None. Barun Kumar reports was provided by None. Barun Kumar reports a relationship with None that

includes:. Barun Kumar has patent None pending to None. Nothing to declare. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

Data availability

Data will be made available on request.

Acknowledgments

None.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.toxrep.2024.101755](https://doi.org/10.1016/j.toxrep.2024.101755).

References

- [1] Cannabis users worldwide number by region 2011-2019 | Statista n.d. (<https://www.statista.com/statistics/264734/number-of-cannabis-users-worldwide-by-region/>) (accessed June 28, 2022).
- [2] P. Biswas, P. Mishra, D. Bose, A. Durgbanshi, Cannabis: a neurological remedy or a drug of abuse in India, *CNS Neurol. Disord. Drug Targets* 16 (2017), <https://doi.org/10.2174/1871527316666170424115008>.
- [3] R. Bhardwaj, A. Kandoria, R. Sharma, Myocardial infarction in young adults-risk factors and pattern of coronary artery involvement, *Niger. Med. J.: J. Niger. Med. Assoc.* 55 (2014) 44, <https://doi.org/10.4103/0300-1652.128161>.
- [4] S. Mohapatra, N. Rath, Appraisal of the narcotic drugs and psychotropic substances (amendment) act, 2014, *Asian J. Psychiatr.* 14 (2015) 80–81, <https://doi.org/10.1016/J.AJP.2015.03.001>.
- [5] I. Casier, P. Vanduyhoven, S. Haine, C. Vrints, P.G. Jorens, Is recent cannabis use associated with acute coronary syndromes? An illustrative case series, *Acta Cardiol.* 69 (2014) 131–136, <https://doi.org/10.1080/AC.69.2.3017293>.
- [6] S.L. Puhl, Cannabinoid-sensitive receptors in cardiac physiology and ischaemia, *Biochim Biophys. Acta Mol. Cell Res* 1867 (3) (2020) 118462 [doi:10.1016/j.bbamcr.2019.03.009](https://doi.org/10.1016/j.bbamcr.2019.03.009).
- [7] Z. Dahdouh, V. Roule, T. Lognoné, R. Sabatier, G. Grollier, Cannabis and coronary thrombosis: what is the role of platelets? *Platelets* 23 (3) (2012) 243–245, <https://doi.org/10.3109/09537104.2011.601824>. Epub 2011 Aug 2. PMID: 21806494.
- [8] K.J. Mukamal, M. Maclure, J.E. Muller, M.A. Mittleman, Binge drinking and mortality after acute myocardial infarction, *Circulation* 112 (25) (2005) 3839–3845, <https://doi.org/10.1161/CIRCULATIONAHA.105.574749>. PMID: 16365208.
- [9] A.M. Yurasek, E.R. Aston, J. Metrik, Co-use of alcohol and cannabis: a review, *Curr. Addict. Rep.* 4 (2) (2017) 184–193, <https://doi.org/10.1007/s40429-017-0149-8>. Epub 2017 Apr 27. PMID: 32670740; PMCID: PMC7363401.
- [10] J.R. Richards, G.D. Singh, A.K. Parikh, S. Venugopal, Acute coronary syndrome after cannabis use: correlation with quantitative toxicology testing, *Am. J. Emerg. Med* 37 (2019) 1007.e1–1007.e4, <https://doi.org/10.1016/J.AJEM.2019.02.017>.
- [11] C.M. Andre, J.F. Hausman, G. Guerriero, Cannabis sativa: the plant of the thousand and one molecules, *Front. Plant Sci.* 7 (2016) 19, <https://doi.org/10.3389/FPLS.2016.00019/BIBTEX>.
- [12] J.R. Richards, Mechanisms for the risk of acute coronary syndrome and arrhythmia associated with phytogenic and synthetic cannabinoid use, *J. Cardiovasc Pharm. Ther.* 25 (2020) 508–522, <https://doi.org/10.1177/1074248420935743>.
- [13] J.B. Ruidavets, P. Ducimetière, A. Evans, M. Montaye, B. Haas, A. Bingham, et al., Patterns of alcohol consumption and ischaemic heart disease in culturally divergent countries: the prospective epidemiological study of myocardial infarction (PRIME), *BMJ* 341 (2010) 1146, <https://doi.org/10.1136/BMJ.C6077>.
- [14] R.D. Crean, N.A. Crane, B.J. Mason, An evidence-based review of acute and long-term effects of cannabis use on executive cognitive functions, *J. Addict. Med* 5 (1) (2011), <https://doi.org/10.1097/ADM.0B013E31820C23FA>.
- [15] R. Radhakrishnan, S.T. Wilkinson, D.C. D'Souza, Gone to pot – a review of the association between cannabis and psychosis, *Front. Psychiatry* 5 (2014), <https://doi.org/10.3389/FPSYT.2014.00054>.
- [16] F.M.J. Gresnigt, M. Hulshof, E.J.F. Franssen, J.W. Vanhommerig, D.W. de Lange, R. K. Riezebos, Recreational drug use among young, hospitalized patients with acute coronary syndrome: a retrospective study, *Toxicol. Rep.* 9 (2022) 1993–1999, [doi:10.1016/j.toxrep.2022.10.016](https://doi.org/10.1016/j.toxrep.2022.10.016).