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## Death After Marijuana Use in a 27-Year-Old Male: a Case Report

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# Death After Marijuana Use in a 27-Year-Old Male: a Case Report

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## Abstract

The dangers of marijuana use are well documented across most body systems. We report a 27-year-old male who ingested marijuana and then experienced an ST-elevation myocardial infarction, subsequent cerebrovascular accident, and death within the span of a week. Toxicology reports were positive for THC only, echocardiography revealed diffuse hypokinesis with an ejection fraction estimated at 15-20%, and troponins peaked at greater than 270,000 pg/mL. Due to decreased Glasgow Coma Score and hemodynamic instability, the patient was not taken for cardiac catheterization, but was subsequently sedated, intubated, and placed on pressor support in the ICU. Initial brain imaging was negative for acute intracranial process but repeat head CT on day four of hospitalization showed diffuse cerebral edema and anoxic brain injury. At the request of the family, he remained on ventilator and hemodynamic support until a nuclear perfusion scan confirmed anoxic encephalopathy. He died within five minutes of extubation on day ten of his hospital stay.

## Keywords

substance abuse, st-elevation myocardial infarction, toxicology

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## Conflict of Interest Statement

No conflicts of interest

## Cover Page Footnote

Footnote for Figure 1: Figure 1. Presenting ECG. Sinus tachycardia with ST segment elevations in the anterior and lateral leads and left axis deviation. Acknowledgements: please consider starred (\*) authors as co-first authors

## CASE REPORT

# Death After Marijuana Use in a 27-Year-Old Male: A Case Report

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## Abstract

Marijuana use has increasingly been associated with acute coronary syndrome in young people, and other case reports to date have detailed non-fatal cardiac events following marijuana use. We report a 27-year-old male who had multi-route consumption of marijuana and then experienced an ST-elevation myocardial infarction, subsequent cerebrovascular accident, and death within the span of a week. Toxicology reports were positive for THC only, echocardiography revealed diffuse hypokinesis with an ejection fraction estimated at 15–20%, and troponins peaked at greater than 270,000 pg/mL. Due to decreased Glasgow Coma Score and hemodynamic instability, the patient was not taken for cardiac catheterization, but was subsequently sedated, intubated, and placed on pressor support in the ICU. Initial brain imaging was negative for acute intracranial process but repeat head CT on day four of hospitalization showed diffuse cerebral edema and anoxic brain injury. At the request of the family, he remained on ventilator and hemodynamic support until a nuclear perfusion scan confirmed anoxic encephalopathy. He died within 5 minutes of extubation on day ten of his hospital stay.

**Keywords:** Substance abuse, ST-elevation myocardial infarction, Toxicology, Cannabis, Marijuana

## 1. Background

The last two decades have seen an increase in case reports and studies concerning the deleterious health effects of marijuana use, particularly adverse cardiovascular events.<sup>1,2</sup> Marijuana has been associated with myocardial infarction, cardiomegaly, and both atrial and ventricular tachycardias. Of the two active compounds of marijuana, delta-9-tetrahydrocannabinol (THC) is responsible for the psychoactive and euphoric effects, while cannabidiol (CBD) is believed to be anti-inflammatory and to modulate the euphoric effects of THC.<sup>3</sup> THC acts on the G-protein coupled cannabinoid receptor 1 (CB1R), a part of the endocannabinoid system (ECS). Found in the brain, heart, vascular smooth muscle, and peripheral nervous system, this receptor impacts signal

transduction in multiple systems. Vascular effects of THC seem to be dependent on tissue type, with vasodilatory responses through inhibition of voltage gated calcium channels in congruence with vasoconstriction of the coronary, cerebral, and peripheral arterial systems.<sup>4</sup> Marijuana can thus induce an increase in heart rate, myocardial oxygen demand, and both systolic and diastolic blood pressure, as well as bradycardia and hypotension. Decreased cerebral blood flow and increased risk of ischemic stroke have been reported.<sup>3,4</sup> The quality of effect is often based on the mode of consumption: vaporized marijuana produces greater psychoactive effects and higher THC blood concentrations within seconds of inhalation as plasma THC levels reach a maximum after 15–20 minutes.<sup>4</sup> Ingested marijuana induces peak concentrations at 2–3 hours and has more unpredictable bioavailability. This variability

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often leads to greater consumption and higher blood THC concentration as the user does not feel the psychoactive effects as quickly. Impairment of memory, attention, and executive function can occur with ingestion of 5–20 mg of THC, and lethal doses in animal studies ranged from 40 mg/kg to 130 mg/kg intravenously.<sup>5</sup>

## 2. Case report

A previously healthy 27-year-old Caucasian male presented to the emergency room with emergency medical services after experiencing sudden cardiac arrest in his home following ingestion of THC in the form of homemade edibles plus an unknown amount of inhaled marijuana. Family reports stated that he ingested approximately 600 mg. Others partook in the edibles in lesser amounts; they reported no significant symptoms. Two hours later, the patient was found unresponsive.

On arrival of EMS the patient was found unresponsive and resuscitation efforts, which the patient's brother initially undertook, were taken over by first responders. A 12-lead EKG revealed ventricular fibrillation. Analysis of emergency room chart estimates a total of 40 min downtime, 6 defibrillations delivered, and 450 mg of amiodarone utilized in the course of the patient's resuscitation. The patient experienced ventricular fibrillation several times enroute to the hospital and arrived in the emergency room on an amiodarone drip still receiving CPR with a Glasgow Coma Scale of 3. The patient was sedated, intubated, and placed on hemodynamic support in the ICU.

Initial troponins measured at 462 and peaked >270,000 pg/mL. ECG showed ST elevations in anterolateral leads, but due to hemodynamic instability and neurologic status, the patient was not taken for cardiac catheterization (see ECG in Fig. 1).

Urine drug screening tested positive only for THC, but more extensive screening was not able to be performed, so it is unclear whether there were any synthetics or fentanyl present (labs are reported in Table 1).

Echocardiography performed on day two of the hospitalization showed the patient's estimated ejection fraction severely reduced at 15% with akinesis of the apical anterior and apical myocardium and severe hypokinesis in mid-anterior, mid-antero-septal, and apical inferior myocardium. The left ventricular filling pattern was pseudo normal with increased filling pressures and an estimated grade II diastolic dysfunction.

Over the course of the week, the patient's neurologic status did not improve, and it was recommended to perform a cerebral perfusion scan. The scan on day ten of his ICU stay confirmed suspected brain death. The family elected to remove him for ventilator support, and he died within 10 min.

## 3. Discussion

A 2021 study of adolescents aged 12–17 in the United States reported that 19% of adolescents saw no perceived risks of harm from monthly cannabis use.<sup>5</sup> Marijuana use reached an all-time high in 2021 among young adults aged 19–30 years old, with 43% of young adults reporting marijuana use in the past year.<sup>6</sup> Changing legislation surrounding legalized use of marijuana in the last decade has likely affected these perceptions of young adults.

Increased social acceptance, ease of availability, and changing legalization of marijuana are likely to play a role in the increased prevalence of users. As of November 2022, twenty-one states and the district of Columbia have approved measures to regulate cannabis for non-medical adult use.<sup>7</sup> In New York State, where these events took place, legislation

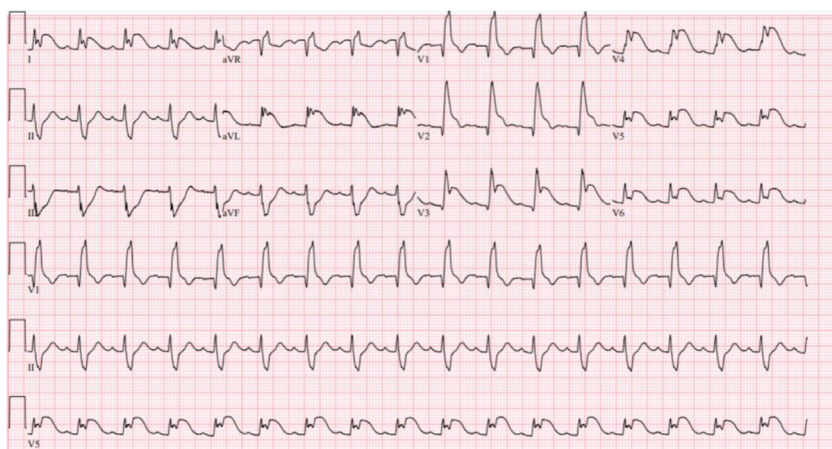


Fig. 1. Patient's ECG on arrival showing STEMI with an anterolateral injury pattern.

Table 1. Laboratory results.

Lab test	Patient	Lab reference
ABG pH	<7.00	7.35–7.45
Blood glucose	373	74–109 mg/dL
Creatinine kinase	1156	30–223 Units/L
Drug Screen Panel, Urine:		
Amphetamine	NEGATIVE	NEGATIVE Positive cutoff = 1000 ng/mL
Barbiturates	NEGATIVE	NEGATIVE Positive cutoff = 200 ng/mL
Benzodiazepines	NEGATIVE	NEGATIVE Positive cutoff = 200 ng/mL
Buprenorphine	NEGATIVE	NEGATIVE Positive cutoff = 5 ng/mL
Cocaine	NEGATIVE	NEGATIVE Positive cutoff = 300 ng/mL
Methadone	NEGATIVE	NEGATIVE Positive cutoff = 300 ng/mL
Opiate	NEGATIVE	NEGATIVE Positive cutoff = 300 ng/mL
Oxycodone	NEGATIVE	NEGATIVE Positive cutoff = 300 ng/mL
Phencyclidine (PCP)	NEGATIVE	NEGATIVE Positive cutoff = 25 ng/mL
Propoxyphene	NEGATIVE	NEGATIVE Positive cutoff = 300 ng/mL
THC (Cannabinoids)	POSITIVE	NEGATIVE Positive cutoff = 50 ng/mL
Lactic acid	11.6	0.5–1.9 mmol/L
Rapid ID Panel NP Swab PCR:		
CoV-2	NEGATIVE	NEGATIVE
Influenza A/B	NEGATIVE	NEGATIVE
RSV	NEGATIVE	NEGATIVE
Troponin I High Sensitivity:		
Initial	462	2–20 pg/mL
24 h	>270,000	2–20 pg/mL
Peak	>270,000	2–20 pg/mL
White blood cell count	22.4	4.0–11.0 $10 \times 3/\mu\text{L}$

CoV-2 = Coronavirus 2 (aka: COVID-19); NP = Nasopharyngeal; PCR = Polymerase Chain Reaction; RSV = Respiratory Syncytial Virus.

allows for a new loophole in the sale of marijuana with “sticker shops,” which provides complimentary forms of marijuana after the purchase of a shop item. The Marijuana Regulation and Taxation Act (MRTA) of 2021 legalized adult-use cannabis and established the Office of Cannabis Management (OCM).<sup>8</sup> The law was not explicit concerning the practice of gifting marijuana, allowing the establishment of unregistered dispensaries. The OCM has since released statements deeming this practice illegal; however, enforcement of the law is inconsistent. Because these shops operate without a license, the product is largely unregulated, without reporting and testing of the product that is required to hold a dispensary license. States considering the decriminalization and legalization of marijuana should consider cases such as these. Unregulated sale of marijuana without proper identification of the components severely limits hospital abilities to

treat patients who may have ingested multiple drugs or synthetic products not easily detected on basic urine drug screening. Local providers have commented on an increase in emergency room visits involving these substances of questionable origin. Our hospital is unable to test for synthetics, and we cannot quantify THC blood levels. Health-care facilities would benefit from updated laboratory testing for illicit substances in order to benefit both patients and providers.

This case report has several limitations. Without more extensive drug testing, we cannot say if there were other drugs or synthetic products contributing to the patient's STEMI and cardiac arrest. While accounts from the family confirmed 600 mg orally plus an unknown inhaled amount of THC, the hospital was unable to confirm the patient's THC blood level. Finally, the patient's blood glucose on admission was 373 with an anion gap of 21, but we

had no prior health documentation to suggest that the patient was diabetic, and the possibility of diabetic ketoacidosis was not explored at the time of admission. Glucose trending throughout the patient's ICU stay suggests that the initial elevation was likely a stress reaction.

#### 4. Conclusion

Our report adds to the growing pile of evidence that marijuana use can induce myocardial infarction. While other case reports have described non-fatal cardiac events after marijuana inhalation, this case report represents a fatal cardiac event after multi-route consumption of marijuana products. This case provokes questions about marijuana toxicity and routes of administration, quality of hospital-based toxicology testing, and the effects of new state laws surrounding the sale and use of marijuana.

#### Conflict of interest

The authors have no conflicts of interest to report.

#### Sources of funding

None.

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