Case report

Recovery from spinal cord infarction associated with cannabis use

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Context: Cerebrovascular and cardiovascular accidents have been associated with illicit drug use. The most commonly used substance worldwide is cannabis. It has been related to acute ischemic cerebral stroke in multiple reports, with different mechanisms suggested.

Findings: This is a case of Acute Spinal Cord Ischemia Syndrome (ASCIS) in a 25-year-old male who presented 20 minutes after smoking cannabis. Although a direct causal relationship between cannabis and cerebrovascular accidents is difficult to establish, there might be an association.

Conclusion: The presented patient didn't have any vascular risk factors, and his symptoms started 20 minutes after smoking cannabis. This signifies a possible association between ASCIS and cannabis use.

Keywords: Cannabis, Marijuana, Spinal cord injury, Ischemic, Stroke, Infarction

Introduction

Cannabis is the most commonly used illicit drug in the world.¹ It is widely perceived as a harmless drug.² Its use is gaining popularity worldwide, especially after being legalized in many countries.² Cannabis contains over 400 compounds, including more than 60 cannabinoids. The pharmacology of most of these cannabinoids is largely unknown, but the most psychoactive and potent agent Δ^9 -tetrahydrocannabinol (Δ^9 -THC, or THC) has been isolated and well studied.³ Two cannabinoid receptors have been identified, CB1 and CB2. The CB1 receptors are predominantly found in the central and peripheral nervous system, and are responsible for impairing the cognitive and psychomotor performance. Whereas CB2 receptors are present on the immune cells and are involved in cytokine release.^{1,3} The effects of Cannabis on the central nervous system combines many of the properties of alcohol, tranquilizers, opiates and hallucinogens; it is anxiolytic, sedative, analgesic and psychedelic.^{1,3} These properties cause the desired effects of self confidence, euphoria, relaxation, and recreation. The psychological effects start within several minutes and last from 2 to 4 hours.⁴

Case report

A previously healthy 25-year-old male was brought into the emergency department with bilateral lower extremity paralysis. His social history was significant only for occasional alcohol and cannabis use, without any use of tobacco. He reported smoking marijuana heavily with his girlfriend 20 minutes prior to presentation when he lost control over his lower extremities instantaneously. He denied any other substance use prior to the incident. In the emergency department, his blood pressure was 109/57 mmHg, with a pulse of 74, temperature of 37.1 °C, and a respiratory rate of 14. On physical examination, he was paraplegic with 0/5 muscle strength as per Oxford grading scale (Quadriceps femoris, biceps femoris and calf muscles). There was markedly decreased sensation of touch, temperature and vibration in his lower extremities extending all the way up to just above his nipples (T2 dermatomal distribution). Babinski sign was present bilaterally. He also had bilateral patellar hyporeflexia with 1+ on the deep tendon reflexes scale. Sensory and motor powers were intact in his upper extremities. Cranial nerves' examination was unremarkable. His bladder was distended; an indwelling catheter inserted drained 1.2 L of urine. Upon further history taking, the patient admitted using heroin only once in his life, and it was a year prior to his presentation.

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Blood testing done showed a normal CBC, and normal serum chemistries. Continued ECG monitoring and transthoracic echocardiography excluded any potential arrhythmia or thrombus formation. Urinalysis was unremarkable; serum salicylate, alcohol and acetaminophen levels were all not detected. Urine toxicology screen was only remarkable for the presence of THC. Testing for hepatitis B, hepatitis C, HIV, and syphilis were negative. In addition, a complete hypercoagulable state workup was unremarkable.

MRI of the thoracic spine with and without contrast showed the following findings: diffuse abnormal signal intensity extending from mid C7 through mid T10 predominantly involving the entire circumference of the spinal cord. This signal is hypo to iso-intense on the T1-weighted (Fig. 1), hyperintense on the T2 (Fig. 2), and diffusion weighted images (Fig. 3). Following intravenous administration of gadolinium, there was patchy enhancement. These findings are consistent with the clinical impression of spinal cord infarction.

During his 6-day hospital stay, patient was started on Aspirin 81 mg; he was eating independently; required supervision with grooming, bathing, and bed to chair transfer. He was able to ambulate using a rolling walker with some assistance. Patient was able to void on his own without any residual urine, and he was fully able to sense temperature, touch and vibration in his lower

Figure 2. T2 weighted MRI

Figure 1. T1 weighted MRI

Figure 3. DWI MRI

extremities. He was also able to defecate on his own. Upon discharge, his muscle strength was 3⁺/5 as per Oxford grading scale in his bilateral lower extremities (Quadriceps femoris, biceps femoris and calf muscles). Patellar reflexes were normal with 2+ on the deep tendon reflexes scale. In addition, he was able to maintain a full penile erection, which he wasn't able to do during the first 2 days of his hospitalization. Afterwards, he was discharged to an inpatient rehabilitation facility where he continued to improve over the next few weeks, and became fully ambulatory in few months.

Discussion

Cannabis ingestion or inhalation can result in a variety of side effects; the most frequent being psychiatric.⁴ There are numerous cardiovascular changes reported from cannabis. Its use increases myocardial oxygen demand and decreases oxygen delivery.⁵ There is a dose dependent increase in cardiac rate, cardiac output, and no change or slight increase in supine blood pressure.^{6,7} Peripheral vascular resistance decrease, especially in the erect position, posing a risk of orthostatic hypotension.^{6,7} The risk of myocardial infarction was found to be elevated 4.8 fold in the hour after cannabis use.⁷ There has been an association with paroxysmal atrial fibrillation.⁸ Moreover, in chronic users, it has been associated with increased cerebrovascular resistance and decreased cerebral blood flow, leading to brain hypoactivity.^{9–13} While on the other hand, acute administration of cannabis results in increased regional cerebral blood flow.^{14–17}

Acute ischemic stroke has been increasingly reported to be associated with cannabis consumption. One systemic appraisal of the literature identified 34 case reports on 64 patients with cerebrovascular accidents related to cannabis use; 81% of them exhibited a temporal relationship between cannabis exposure and the index event.¹⁸ The previous reports proposed different mechanisms for acute ischemic strokes in the context of cannabis use. These include deterioration in vasomotor reflexes, which causes altered cerebral auto-regulation leading to regional hypoperfusion and stroke subsequently. In addition, there might be a role for some active metabolites causing a pro-thrombotic state, but this has been proposed mainly with synthetic cannabinoids.¹⁹ Other mechanisms suggested a toxic or an immune mediated inflammatory vasculopathy; or even a vasospastic reaction directly from cannabis, or as a reflex reaction due to systemic hypotension.^{19–28} One report proved the mechanism of vasospasm by identifying a subset of young patients who presented with stroke due to multifocal cerebral arterial stenosis, which was fully reversible; cannabis was a major precipitating

risk factor among them.²⁹ Another possible mechanism could be the role of oxidative stress on brain mitochondrial function. One article showed that mitochondrial coupling was significantly decreased after exposing a rat brain to Tetrahydrocannabinol. In addition, there was a significant increase in H₂O₂ production and free radicals by cerebral mitochondria; thus increasing oxidative stress and mitochondrial dysfunction.³⁰

In our case report we identified an acute neurologic event related to cannabis use of different type, i.e. involving the spinal cord. To date, there are no reports found in the literature that describe spinal cord ischemia in association with cannabis use. Acute Spinal Cord Ischemia Syndrome (ASCIS), also referred to as spinal cord infarction when it reaches its utmost severity, is a relatively infrequent vascular pathology of the central nervous system.³¹ It accounts for 1.2% of acute stroke hospitalizations.³² The spinal cord is supplied by three longitudinal arteries, a single anterior spinal artery which supplies the anterior two-thirds of the spinal cord, and two posterior spinal arteries that supply the posterior one-third of the spinal cord. Spinal cord ischemia is often located in the ASA territory given the dual PSAs supply and the dual pial collateral network of vessels.

Survival following spinal cord infarction is fair, yet it can cause severe debilitation and permanent disabling sequelae.³³ One analysis for the functional outcomes of 36 patients with spinal cord infarction showed that only 18% of them were fully ambulatory upon discharge.³¹ Whereas 57% of them became wheelchair dependant, and 25% were able to ambulate with technical aid.³¹ Etiologies for spinal cord infarction include arteriosclerosis, thromboembolism, acute systemic hypotension, aortic and spinal surgeries and other vascular procedures. The most common cause of ASCIS cases was idiopathic; 36.1% of the 36 patients in the analysis were identified as idiopathic.³¹ Spinal cord infarction secondary to substance use has been reported in the literature. The case reports documented cocaine as the main insulting agent, with mechanisms including vasospasm, arteritis, and thrombosis.^{34–37}

The patient described in this report was extensively worked up for any underlying etiologies. Additionally, he didn't have any significant risk factors for stroke, such as family history, hypercoagulability state, tobacco use or cardiac dysrhythmias. It is unlikely that heroin had any role in this case, as the patient used it only once in his life and it was 1 year ago. Therefore, given the increasing number of case reports linking cannabis consumption to acute stroke, the use of cannabis could be a precipitating factor to ASCIS in this otherwise healthy patient.

Conclusion

Cannabis is generally perceived as a safe substance among the public, with few side effects, yet previous reports suggest it might not be the case, as it can precipitate acute ischemic stroke. In this report we present the first case in the literature of ASCIS happening 20 minutes after smoking Marijuana. Given the widespread use of cannabis, it is difficult to determine whether this was a rare idiopathic vascular phenomenon that is purely coincidental and not related to cannabis use, or that cannabis precipitated an ischemic vasospastic response. Although there is no definite causal relationship between cannabis and ASCIS, the temporal profile of the case is a warning sign for the medical community and the general population.

Disclaimer statements

Contributors None.

Funding None.

Conflict of interest None.

Ethics approval None.

Author declarations: This manuscript was not funded by any organization. The author has no conflict of interest.

Informed consent: Use of patient data complies with HIPAA requirements

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