



Cannabis-related emergencies in children and teens

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Purpose of review

To examine the spectrum of emergency department presentations associated with cannabis use or misuse that are currently seen in the pediatric population.

Recent findings

There is a growing concern that pediatric emergency department visits related to cannabis are on the rise, especially given rapidly changing legislation on cannabis and its broad availability in certain areas. These concerns are substantiated in the current literature, as the evidence mounts for an array of emergency department presentations of intentional or accidental cannabis use. The range of presentations documented in the recent literature spans gastrointestinal, psychiatric and cardiorespiratory effects, in addition to traumatic injuries and accidental ingestions by younger children. Complications of chronic cannabis use, such as 'cannabis hyperemesis syndrome', depression, psychosis or cognitive impairment, are now recognized outcomes and even more are likely to emerge.

Summary

An array of cannabis-related symptoms is possible from acute use or exposure. Common presentations include acute intoxication, hyperemesis, depression and acute physical injuries from impaired psychomotor function. Uncommon presentations include cardiorespiratory effects, and a range of symptoms in young children that include hyperkinesia and coma. Clinical vigilance is needed to suspect and clinically diagnose cannabis exposure in the emergency department.

Keywords

cannabis, emergency, pediatric

INTRODUCTION

Marijuana, or cannabis, is now the most common substance used by adolescents in the United States [1*,2]. Cannabis typically appears in one of three main forms – 'edibles,' tinctures or tobacco-like for smoking. Edibles include baked goods, candy (including gummies) and beverages that are made with cannabis oil. The edible form is becoming more popular among adolescents as it can be indistinguishable from regular food [3]. Tinctures are made from cannabis in a solution of alcohol that is placed under the tongue for rapid absorption. Finally, the class of smoked cannabis products includes pure dried cannabis or hashish, which is a dried cannabis resin. These smokable forms are also often mixed with tobacco before inhalation. Tobacco use in the form of electronic cigarettes has been on the rise in the adolescent population overall, with up to one third also using cannabis via electronic cigarettes [4*].

The decriminalization or even legalization of marijuana across the United States and

internationally has become more widespread in the last 5 years. Laws pertaining to cannabis fall into three categories – cultivation, medical use and recreational use. Canada and Uruguay are the only two countries in the world that have completely legalized cannabis in all three of the above realms. These changes happened in 2018 and 2013, respectively. Although cannabis remains illegal on a federal level in the United States, there has been a surge of state-level legislative change surrounding the use of cannabis. In the past 6 years, 10 states have been the first to legalize the recreational use of cannabis for adults (over 21 years old), and 13 additional states have decriminalized cannabis.

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KEY POINTS

- Common presentations of cannabis intoxication include acute intoxication, hyperemesis, depression and acute physical injuries from impaired psychomotor function.
- Uncommon presentations of cannabis intoxication include cardiorespiratory effects, and a range of symptoms in young children that include hyperkinesia and coma.
- Clinical vigilance is needed to suspect and clinically diagnose cannabis exposure in the emergency department.

Changes in the legal status of cannabis for adults have led to increased overall availability in many regions, including for teens and children. This in turn has magnified cannabis use and accidental exposures in the pediatric population. Studies conducted in Washington and Colorado since the commercialization of medical and recreational cannabis document an increase in cannabis-related emergency and urgent care visits in the pediatric population [5[•],6]. The rate of adolescent cannabis use in the United States has risen 21% between 2008 and 2011 and now exceeds that of tobacco [7]. There is a concomitant rise in accidental exposures for young children [8]. Despite these statistics, the perceived risk of harm from marijuana use is demonstrated as lower in states that have passed medical marijuana laws [7]. Given the broad impact of marijuana use today, we will review the current evidence on cannabis-related emergency department visits by pediatric and adolescent patients.

COMMON PRESENTATIONS OF CANNABIS EXPOSURE

Acute intoxication

Cannabis can lead to a desired 'high' yet also to undesired effects in the acute phase after ingestion or inhalation. Signs of acute intoxication include slurred speech, increased appetite, dry mouth, nystagmus, conjunctival injection and ataxia. There can also be vital sign changes such as tachycardia, tachypnea and hypertension. Hallucinations, anxiety or dysphoria is common with cannabis naive patients or those who take high-potency products [9[•]]. In the high-stimulation setting of an emergency department, it can be helpful to find a more dimly lit, quiet space for patients with acute cannabis intoxication and to provide verbal reassurance of the expected temporary effects. For those with mild to moderate intoxication, a benzodiazepine can be

trialed to reduce anxiety and dysphoria. Severe cannabis intoxication and/or physiologic changes may result from coexposure to other recreational drugs.

Gastrointestinal effects

Cannabis has played an important medical role in the treatment of chemotherapy-related nausea, anorexia and vomiting via stimulation of intestinal CB1 antiemetic receptors. Conversely, chronic cannabis abuse can result in 'cannabinoid hyperemesis syndrome' (CHS), which was first described in 2004. Although the pathophysiology of CHS is unknown, it is theorized that the overstimulation of enteric nervous system CB1 receptors creates a paradoxical effect that causes nausea. Another theory is that daily cannabis use may desensitize the CB1 receptors [10[•]].

CHS is clinically defined by the ROME IV criteria (Table 1) [11] yet can be indistinguishable initially from cyclic vomiting syndrome. A patient typically presents with repeated episodes of abdominal pain, nausea and vomiting. The history and diagnosis may be supported by symptom relief with hot showers. Diligent history-taking, often without a parent present, can help to uncover the use of cannabis as a culprit for hyperemesis.

Since CHS was first described, the rate of emergency department visits for cannabis-related vomiting has increased from 2.3 to 13.3 per 100 000 emergency department visits [12[•]]. In Colorado, there was an increase in the number of emergency department visits for CHS from 2012 to 2014, with a disproportionate increase among tourists [13,14[•]].

Early recognition of CHS may preclude unnecessary diagnostic evaluation. Nonetheless, patients may undergo an extensive work-up including laboratory, imaging and endoscopic evaluation to assess for another underlying organic cause before the diagnosis of CHS is made. Aside from nonspecific electrolyte abnormalities and positive cannabinoid testing, the diagnostic evaluation is largely negative.

Table 1. ROME criteria for cannabinoid hyperemesis syndrome

- All three criteria must be present and must be fulfilled for last 3 months with symptom onset at least 6 months before diagnosis.
- (1) Stereotypical episodic vomiting resembling cyclic vomiting syndrome in terms of onset, duration and frequency (i.e. at least one discrete episode in the prior year and two episodes in the past 6 months, occurring at least 1 week apart).
 - (2) Presentation after prolonged excessive cannabis use (3–5 times daily for at least 2 years)
 - (3) Relief of vomiting episodes by sustained cessation of cannabis use

The severity of CHS can vary from mild dehydration to dehydration-related acute kidney injury with electrolyte derangement. There have even been two fatal cases of CHS reported in a 27 year-old woman and a 27 year-old man in separate scenarios [10[¶]]. The chronic and prolonged vomiting was presumed to lead to volume depletion, electrolyte disturbances and hypoglycemia that resulted in altered mental status as the consequence of CHS. Although these were not pediatric patients, they were otherwise healthy and less than a decade apart in age from the adolescent population.

The acute management for CHS includes laboratory evaluation of electrolytes, glucose, with either oral or intravenous rehydration depending on severity and tolerance. For nausea, antiemetics including ondansetron, promethazine, metoclopramide, lorazepam, diphenhydramine or haloperidol may be trialed [15^{¶¶}]. A 2017 case series of 13 patients reported that the application of topical capsaicin provided symptom relief and improved tolerance of oral fluids in an emergency department setting [16]. Capsaicin cream 0.075% is available over the counter and can be applied to the abdomen or back of arms three times a day. Gloves should be worn, and hands washed after application as it can be irritating or cause chemical burn if mucosal membranes are accidentally exposed. Opioids should be avoided for the treatment of CHS-associated abdominal pain given the potential for addiction. Ultimately, the only definitive treatment for CHS is cessation of cannabis use.

Psychiatric effects

Cannabis is known to have psychoactive properties, with tetrahydrocannabinol (THC) as the primary psychoactive constituent. THC directly acts on the endocannabinoid system and indirectly on the glutamatergic, GABAergic and dopaminergic systems [17[¶]]. Endocannabinoid receptors are found in high concentrations in the frontal and limbic areas of the cortex, hippocampus, amygdala, cerebellum, thalamus and basal ganglia. The adolescent brain has increased expression of cannabinoid receptors and thus may be more vulnerable to the effects of THC. In addition, there are long-term concerns about the adverse effects of THC on neurodevelopment.

Exposure to cannabis can produce short-term desirable effects such as euphoria, relaxation and sensory intensification. However, many may also experience increased anxiety, paranoia, decreased psychomotor performance and cognitive dysfunction. There is increasing evidence that chronic cannabis use may result in psychosis and/or cognitive impairment [18,19]. It has also been proposed to be

associated with the possible development of schizophrenia although direct causation has not been confirmed [20[¶]].

In an adolescent cohort 12–15 years of age who presented with suicidal ideation, cannabis use was associated with an increased likelihood of a suicidal attempt [21[¶]]. A study from Colorado evaluating mental health visits in the emergency department showed that the prevalence of mental health conditions with cannabis-associated diagnostic codes is higher than those without cannabis [22[¶]]. From a pediatric emergency department perspective, cannabis abuse should be considered for patients who present with psychiatric symptoms of acute anxiety, panic attacks or psychosis including delusions and hallucinations. Furthermore, patients who admit to or test positive for cannabis use should be screened for depression and suicidal ideation. For patients presenting with acute psychosis because of cannabis use, the same principles of management for primary psychosis can be applied. Studies have not shown any clear differences in efficacy between common antipsychotic medications for these patients [23,24[¶]].

Acute physical injuries

Cannabis use can lead to increased physical injuries, as acute ingestion can decrease cognitive, perceptive and psychomotor function. Most injuries are unintentional accidents such as falls or motor vehicle accidents. Although driving under the influence of alcohol is known by many adolescents to be a dangerous behavior, there is a lack of parallel awareness as to the adverse effects of cannabis on driving. Without question, cannabis intoxication affects judgment in the adolescent population that can lead to an increase in overall risky behaviors [25[¶]]. Recent studies from Canada show that between 12 and 14% of all age drivers involved in motor vehicle accidents had cannabis in their system [26^{¶¶}]. The same study found that the second most common type (11.3% of injuries) of cannabis-related injuries in pediatric patients is intentional self-harm. These are associated with thoughts or attempts at suicide. Regrettably, 10.5% of cannabis-related injuries in the pediatric population are related to physical assault, burns or neglect by a cannabis-intoxicated care provider.

UNIQUE PRESENTATIONS OF CANNABIS EXPOSURE

Cardiorespiratory

There is a growing body of literature reporting the cardiovascular effects of cannabis in both adult and

pediatric populations. From a cardiovascular standpoint, similarities have been drawn between smoking tobacco and cannabis. There have been two identified types of cannabinoid receptors, CB1 and CB2. CB2 receptors are found in the cardiac myocyte and on smooth muscles of blood vessels [27[■]]. The exact action of cannabis on these receptors is unknown and controlled studies are limited. One study examining the effects of cannabis on healthy volunteers found that there was an increase in resting heart rate [28]. This effect was blunted if pretreated with β -blockers, suggesting a β -adrenergic effect from cannabis. In addition, electrocardiograms (EKGs) showed decreased P wave amplitude and T wave inversions 30 min after smoking cannabis [28]. The potential clinical and symptomatic manifestations associated with the physiologic and EKG changes were not documented.

Clinical cardiac manifestations of cannabis exposure are indeed possible in adolescents and young adults. Reports have varied from arrhythmias to acute coronary syndromes. A recent case report from 2018 documented a 16-year-old man who presented with chest pain after smoking cannabis and was found to have an acute myocardial infarction [29[■]]. His EKG showed diffuse ST segment elevations, testing ruled out other drugs of abuse and infectious causes, and coronary angiography did not reveal any focal lesions or obstruction. A myocardial biopsy revealed a sparse neutrophilic infiltrate. Further reviews have indicated that in the adolescent population, patients with cannabis use had an increased odds ratio (5.03) of having an acute myocardial infarction as compared to nonusers [30[■]].

Arrhythmias have not been reported in the pediatric population, but there have been many cases of atrial fibrillation and ventricular tachycardia in the young adult population attributed to cannabis use. There has even been a documented episode of sinus arrest in a 54-year-old patient who presented with intermittent presyncope and tingling in the left-arm and left side of mouth after acute cannabis inhalation. Because of the possible cardiovascular effects of cannabis, EKG monitoring should be considered in patients presenting with syncope or presyncope in the setting of acute cannabis use.

Finally, for adolescents presenting with chest pain, consideration should be given to the possibility of cannabis-induced pulmonary changes. It is well known that smoke inhalation of any type can trigger wheezing and shortness of breath [31]. However, case reports suggest that the respiratory effects of inhalational cannabis can be more severe, with rapid inhalation triggering spontaneous pneumothorax or pneumomediastinum, or a more

prolonged effect of emphysema from smoking cannabis [32[■],33[■],34].

Accidental ingestions

With the growing availability of edible forms of cannabis comes the concern for accidental ingestions in the younger pediatric population. Edible forms of cannabis are often colorful candies or baked goods with attractive packaging and can be indistinguishable from forms of candy well known to young children. Thus far, there is limited regulation around the packaging of these edible cannabis products to maintain a childproof exterior [35]. There have also been reports of more gradual toxicity in parents giving toddlers hemp oil supplements or products as THC is present in miniscule amounts [36[■]]. The effects of ingested cannabis toxicity may occur within 30 min–3 h. Most commonly, toddlers to elementary school children present with nausea, vomiting, sudden onset ataxia, hyperkinesia and altered mental status including coma [37,38]. A systematic review including 44 articles ($n=3582$ children) reporting accidental cannabis ingestion in children at least 12 years old found that lethargy was the most common presenting symptom (71%), followed by ataxia (14%) [39]. Tachycardia, mydriasis, hypotonia and hypoventilation were also observed [26[■]]. Twenty of the patients required ICU admission, including seven who required endotracheal intubation [37].

As noted above, accidental ingestions of cannabis can be unique in their presentation as there can be a wide range of presentation depending on the dose and potency of the product ingested [40]. A high index of suspicion is needed to make the diagnosis as cannabis may not be readily reported as a household medication or substance [41]. Urine drug testing is important to making the diagnosis, whereas blood screening for cannabis may be negative depending on the timing of the ingestion [42,43]. All cases of accidental cannabis exposure in children should be evaluated by child protection services.

CONCLUSION

Cannabis exposure via inhalation or ingestion can cause a wide spectrum of presentations in the pediatric population. An increase in cannabis use has been demonstrated in the adolescent population, with clear risks of secondary harm or injury. Accidental cannabis exposures in young children also continue to rise and have the potential for devastating outcomes. In a time when cannabis is more widely available overall, emergency medicine

physicians should remain vigilant for acute presentations of cannabis exposure in pediatric patients.

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Conflicts of interest

There are no conflicts of interest.

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