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Brief Communication

Infant with altered consciousness after cannabis passive inhalation

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Introduction

Cannabis is the most commonly used illicit drug worldwide (Bauman & Phongsavan, 1999). Its primary active ingredient is THC (Delta [9]-tetrahydrocannabinol) which exerts its biological effects by activating the cannabinoid receptor CB1 in the brain.

Cannabis abuse has been described almost exclusively in adolescents and adults. In 2002, 50% of 18 year olds reported using cannabis during their lifetime. Of these, 22.4% have met Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) criteria for cannabis abuse and 15.8% have met DSM-IV criteria for cannabis dependence (Cooper & Haney, 2009).

In infancy, cannabis effects are merely discussed in the context of maternal prenatal exposure. These effects include neurobehavioral symptoms such as inattention, impulsivity, increased externalizing behavior and decreased cognitive performance with memory and learning impairments (Huizink & Mulder, 2006).

However, the direct exposure of infants to cannabis substances is discussed neither in clinical assessment nor in public health education. To the best of our knowledge and after surveying the literature using PubMed and Google search, we believe that this is the first reported clinical case of severe toxicity after passive inhalation of cannabis smoke by an infant. The infant was admitted to hospital with severe neurological symptoms, following this toxic exposure. The significance of this topic is far beyond being the first reported case, but it also carries a significant social importance due to the increasing number of young parents who smoke near their children and thus is probably underdiagnosed as toxicology screens are uncommon by implemented in this age group; this fact underscores the importance of our report.

Since cannabis intoxication has the potential to jeopardize the lives and health of young infants, in this report we have aimed to draw attention to the differential diagnosis of THC toxicity in infants with altered state of consciousness; and to

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alert health workers, educators and parents about the health hazards of cannabis substances smoking in their children's presence.

Case report

A previously healthy 13-month-old male infant was admitted to the emergency ward due to apathy, unresponsiveness, loss of appetite and mild fever (38 °C). His parents, a young couple who were vacationers in the area, noticed that once the infant woke up he appeared ill, did not respond to verbal stimuli and refused to eat. They ruled out convulsive fits and the possibility of digestion of toxic substances. Physical examination disclosed mild fever (37.9 °C), lethargy with intermittent restlessness, normotensive fontanel and equal pupils reactive to light. The physical examination was otherwise unremarkable. Complete blood count showed mild microcytic anemia with normal white blood cells count. Blood chemistry including electrolytes, liver enzymes and renal functions was normal. Erythrocyte sedimentation rate, urinalysis, Electrocardiogram (ECG) and chest roentgenogram were normal. Blood and urine cultures were obtained and intravenous ceftriaxone was started. Retrospectively, these cultures were sterile. Qualitative toxicology urine screen was performed by using lateral flow chromatographic immunoassay (INNOVACON), confirmed for accuracy above 97% by Gas Chromatography/Mass Spectrometry (GC/MS). This screen revealed the presence of THC, which was double checked and verified in an additional urine sample. At this stage, the parents admitted that in the evening before they had participated in a party of 20 cannabis smokers in the parents' room at a resort house where the infant was sleeping. Consequently, the infant was passively exposed to cannabis smoke for several hours. A child welfare worker interviewed the parents and was under the impression that the parents were genuinely amazed that cannabis smoke could harm their baby and that intentional abuse or neglect was unlikely in this case. During hospitalization the child was monitored and within hours showed marked improvement under supportive treatment. He was discharged after 48 h under the supervision of the social department.

Discussion

The clinical effects of THC are highly variable among individuals (Ellenhorn & Barceloux, 1988, chap. 30). In adolescents and adults, the acute effects of THC include dizziness, heart rate changes, blurred vision, altered sensorium, cognitive impairment, hallucinations and psychosis (Reece, 2009).

Despite the extensive knowledge on the effect of inhaled THC in adults, the reports on THC effects in infants are scarce and toxicity following passive inhalation of THC in this age group has never been described. The extremely rare clinical reports on children's exposure to THC have been related only to digestion of cannabis cookies. The clinical signs include tachycardia, conjunctival hyperemia, pallor, ataxia, nystagmus, fine tremor, lability of affect and stupor. Signs and symptoms begin several hours after ingestion and usually resolve uneventfully 6 h later (Weinberg, Lande, Hilton, & Kerns, 1983). In a single case report, a 4-year-old girl was described to have mild hypothermia, ataxia, labile affect, confusion and stupor after swallowing cannabis cookies containing up to 200 mg THC (Bro, Schou, & Topp, 1975). Accidental cannabis ingestion has been reported to lead to coma in children (Macnab, Anderson, & Susak, 1989).

In the present case, the infant was presented with altered state of consciousness after inhaling cannabis smoke. Considering that marked improvement was observed within hours following admission under supportive treatment alongside normal physical and laboratory assessments made infection unlikely the cause of the infant condition. Electrolytes' imbalance and kidney and liver failure were also considered and ruled out. However, urine toxicology screen was positive for 11-nor-9-carboxy-delta9-tetrahydrocannabinol (THCCOOH), the primary urinary metabolite of THC. The parents' confirmation of lengthy and heavy exposure to cannabis smoke alongside the natural history of rapid improvement under supportive therapy, confirms the clinical and laboratory diagnosis of THC toxicity in this case. This etiology should be taken into consideration in the differential diagnosis of altered states of consciousness, after excluding more common etiologies.

The parents consistently and firmly denied any drug abuse other than cannabis smoking. Several studies demonstrated that THC metabolites could be detected for several hours or even several days after passive THC inhalation. Significant concentrations of THC metabolites were measured in the urine of 4 volunteers, up to 6 h after they had stayed for 3 h in a room together with other 6 volunteers who had been smoking simultaneously one cannabis cigarette for each (17.1 mg THC for each cigarette) (Law, Mason, Moffat, King, & Marks, 1984). Similarly, cannabinoids were detected in the urine of 5 volunteers who passively inhaled cannabis smoke for 30 min in a small closed car (Morland et al., 1985). Interestingly, THC intoxication was reported in a placebo control subject who complained on dizziness and nausea, had tachycardia and conjunctivitis, and was found to have urinary cannabinoid metabolites (Zeidenberg, Bourdon, & Nahas, 1977). Subjective effects of THC after exposure to side-stream smoke were also reported (Cone & Johnson, 1986). A few reports speculated that children might be affected by passive cannabis inhalation, but clinical manifestations of such exposure were not reported. One study examined the presence of cannabis metabolites in urine samples which were routinely obtained from asymptomatic infants. Low doses of cannabis metabolites were found in the urine of several children. However, the route and specific time of exposure, duration and clinical relevance were not addressed (Bhushan, Ng, Spiller, Gang, & Inamdar, 1994). In one case, an infant presented with hyponatremic seizure and hypothermia was diagnosed with water intoxication and coincidental finding of cannabis metabolites in his urine. The authors questioned the etiologic role of cannabis, in the absence of reports on the behavior of infants who passively inhaled marijuana. Suggested etiology was an excessive water intake due to unmet psychosocial needs in which cannabis use was an additional sign of such an environment (Quinton, Logan, Ramdial, & Walton,

1993). Clinical effect was reported only after infants' forced smoking when teenage girls deliberately blew puffs of marijuana smoke into the noses or open mouths of crying irritable infants to sedate them (Schwartz, Peary, & Mistretta, 1986). However, severe intoxication following passive inhalation in infants was previously reported in other substances such as crack and phencyclidine (Bateman & Heagarty, 1989; Mirchandani et al., 1991; Schwartz & Einhorn, 1986; Welch & Correa, 1980) but not cannabis.

Notably, THC pharmacokinetic has not been studied in infants. THC, a lipophilic compound, tends to accumulate in fat tissues. Thus, it readily crosses the blood-brain barrier and reaches high levels in the brain. Its effect on infants might depend on respiratory parameters as well as body weight, total volume of distribution with regard for the relatively abundant fat tissues in infants and the susceptibility of the developing brain. The fact that the infant is smaller in body mass than an adult may hypothetically result in higher concentrations of THC followed by its noxious effects.

The circumstances under which cannabis might cause intoxication are particularly relevant in the light of the increasing prevalence use of cannabis in the last decade. In the USA, rates of cannabis use in young adults peaked in 1979, which was followed by a long decline until the early 1990s, when use increased again, before leveling off towards the end of the decade (Hall & Degenhardt, 2009). During the last years cannabis use has been increased, with an estimated 162 million (4%) of the world's adults using it in 2004, a 10% increase on use in the mid 1990s (Hall & Degenhardt, 2007). These data suggest that cannabis abuse due to passive inhalation might be found even in young normative and well functioning families as opposed to other forms of abuse in which additional risk factors are usually identified.

Therefore, it is of utmost importance to draw parents' attention to the possibility of abusive effects of passive inhalation of THC in children. As infants seem to be more vulnerable to THC toxicity, passive inhalation of the drug might create a serious health hazard for them.

Pediatricians and health workers should be aware of the clinical manifestations of cannabis intoxication since it is not routinely considered in medical assessment of infants under daily clinical settings. Discrepancy between the severe neurological presentation and the paucity of other findings in the physical examination and routine laboratory assessment should raise the diagnostic possibility of cannabis poisoning. In such cases, urine toxicology screen is imperative.

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