



Do young children with known cannabis intoxication benefit from further neurological-based testing or imaging?

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ABSTRACT

Background: Recent work has demonstrated that children with unintentional cannabis ingestions often undergo extensive ancillary testing such as head imaging or lumbar puncture. To better understand the yield of these tests, our objective was to describe the frequency of additional significant diagnoses in children with cannabis ingestion.

Methods: We performed a retrospective cross-sectional study of the Pediatric Health Information System (PHIS) database, including ED encounters from January 2016 to April 2023 with a diagnosis indicating cannabis exposure in children <6 years of age. We assessed the frequency of co-diagnoses that would be found on head imaging, lumbar puncture, or toxicology testing.

Results: We included 4132 ED encounters for cannabis ingestion from 47 hospitals. Of these, 1243 (30%) received head imaging and 130 (3.1%) underwent lumbar puncture. There were 23 children (0.6%) with diagnosis of skull fracture or intracranial hemorrhage, 4 (<0.1%) with intracranial neoplasm, and 0 (0%) with a diagnosis for meningitis or intracranial abscess. Presence of discharge diagnosis for other drugs was also uncommon. The most frequent drug ingestion co-diagnoses were cocaine in 43 (1.0%) and opioids in 22 (0.5%) encounters.

Conclusion: In children with cannabis intoxication, high rates of head imaging and lumbar puncture are likely driven by the signs of altered mental status at presentation. These data suggest that if cannabis ingestion is considered early and identified quickly with testing, neuroimaging, particularly that with ionizing radiation, may be low yield.

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1. Introduction

Unintentional cannabis ingestions in young children have become a significant public health concern in the United States, [1] with rapidly increasing frequency and severity in recent years [2–4]. Though presenting symptoms vary, cannabis ingestions in young children most commonly present with signs of altered mental status, including lethargy and ataxia [3,5]. These signs are nonspecific, and when the underlying etiology is unknown, the emergency providers must consider diagnoses for which time-to-diagnosis may be an important factor in outcomes. Recently, a study of US children's hospital emergency departments (EDs) demonstrated that nearly one-third of children with cannabis poisoning undergo head computed tomography (CT) [6]. The authors suggested that point-of-care screening might be useful in identifying

cannabis intoxication in order to reduce testing, but cautioned that a positive cannabis test would not rule out other etiologies for altered mental status.

We hypothesize that detection of cannabis intoxication in a young child with altered mental status may make other expensive and invasive testing unnecessary. Our objective in this study was to better understand the frequency of additional significant diagnoses in children with cannabis ingestion.

2. Methods

We performed a retrospective cross-sectional study of the Pediatric Health Information System (PHIS) database. The PHIS database is comprised of encounter-level clinical and billing data from tertiary pediatric hospitals that are part of the Children's Hospital Association (Lenexa, KS) [7]. PHIS includes patient demographics, resource utilization data, and 41 discharge diagnoses for each encounter; data are mostly de-identified and were accessed as a limited data set for this study. This study was approved by our institution's review board with a waiver for informed consent.

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We included all ED encounters between January 1, 2016, and April 30, 2023, with an associated primary or secondary discharge diagnosis indicating cannabis exposure (*International Classification of Diseases Tenth Revision* [ICD-10] codes T40.7 or F12) in children <6 years of age. We considered the presence of any cannabis-related diagnosis code to be an indication of acute unintentional cannabis ingestion or exposure, given that all included patients were <6 years old.

Our objective was to evaluate the diagnostic utility of invasive and expensive testing in children with altered mental status due to cannabis ingestion, specifically lumbar puncture or advanced neuroimaging (CT or magnetic resonance imaging [MRI] of the brain). Therefore, our primary outcome was the presence of a primary or secondary ICD-10 diagnosis that would be discovered on head imaging (skull fracture, intracranial hemorrhage, or intracranial neoplasm) or cerebrospinal fluid analysis (meningitis). Secondary outcomes were the presence of discharge diagnoses for other drugs in addition to cannabis (including opioids, cocaine, ethanol, amphetamines, hallucinogens, benzodiazepines, salicylates, and acetaminophen). Diagnosis codes used for these outcome definitions are shown in the Supplement. We described the frequency and proportion of each outcome diagnosis in the cohort.

3. Results

There were 4132 ED encounters for cannabis ingestion from 47 hospitals. Of these 2076 (50%) were female and 2050 (50%) were male; the median age was 2 years (interquartile range 1–3 years); 36% were discharged from the ED, 54% were admitted to an observation unit or inpatient floor, and 10% required the intensive care unit. For the assessment of resource utilization potentially indicative of assessment of altered mental status, 1243 (30%) children received CT or MRI of the brain, of which 1192 (29%) were CT and 110 (2.7%) were MRI. Evaluation of CSF occurred in 130 (3.1%) children.

There were 23 children (0.6%) with discharge diagnosis of skull fracture or intracranial hemorrhage, 4 (<0.1%) with intracranial neoplasm, and 0 with a diagnosis for meningitis or intracranial abscess. Presence of discharge diagnosis for other drugs was also uncommon. The most frequent drug ingestion co-diagnoses were cocaine in 43 (1.0%) and opioids in 22 (0.5%) encounters (Table 1).

4. Discussion

The findings of this retrospective cross-sectional study demonstrate that while nearly one-third of children diagnosed with cannabis poisoning undergo advanced neuroimaging, the diagnosis of radiologic intracranial findings or infection is quite rare. High rates of head CTs are

likely driven by the signs of altered mental status at presentation; these data suggest that if cannabis ingestion is considered early and identified quickly with testing, neuroimaging, particularly that with ionizing radiation, may be low yield.

Due to the costs and potential harms of radiation, reducing unnecessary head imaging has been a major goal of pediatric emergency medicine research and implementation science in recent years. In our opinion, this work illustrates a pressing need for research and quality improvement in the diagnostic process for children with altered mental status due to cannabis ingestion. When caring for a child with unexplained mental status in the ED, it can be difficult for a clinician to avoid ordering head imaging when there is no reported ingestion and results of a drug screen are not going to be available for hours. Therefore, it is of utmost importance that rapid cannabis testing be available in EDs that care for children. The need for catheterization to obtain a sample in a young child may be a barrier, but if it prevented the need for further invasive testing, the benefits would likely outweigh potential harms.

While cannabis ingestions surpassed all others in frequency in the last few years, [8] other drugs can similarly cause altered mental status and must be considered at presentation. Our study demonstrates that while co-diagnoses for other drug ingestions were uncommon, there was some risk. We suggest that obtaining a rapid point of care cannabis test could help identify the etiology of altered mental status, but further complimentary drug screening panels may still be indicated to discover co-ingestions.

The rapid rise in cannabis poisonings in young children means that the epidemiology of unexplained altered mental status in a toddler has changed. Cannabis ingestion, given the right clinical picture, is now possibly the most common underlying etiology and should be at the forefront of the clinician's mind. We believe that our results further strengthen the notion that implementation of rapid cannabis testing could have a significant impact on the care of these children.

This study has several limitations. PHIS does not include data such as reason for ED presentation, physical exam findings, or imaging results. Because this analysis relies on ICD-10 diagnosis codes for outcome definitions, the results should be considered exploratory and interpreted with caution; the true prevalence of these diagnoses may be greater or smaller.

CRedit authorship contribution statement

Amanda S. Dupont: Writing – review & editing, Writing – original draft, Methodology, Investigation, Conceptualization. **Patrick S. Walsh:** Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Declaration of Competing Interest

Amanda S. Dupont: Declaration of interest: none.

Patrick S. Walsh: Declaration of interest: none.

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Table 1
Discharge Co-Diagnoses in Children with Cannabis Ingestions.¹

Co-Diagnoses ¹ Present	N (%)
Skull Fracture or Intracranial Injury	23 (0.6%)
Brain Neoplasm	4 (<0.1%)
Meningitis	0 (0%)
Intracranial Abscess	0 (0%)
Other Drugs	
Opioids	22 (0.5%)
Cocaine	43 (1.0%)
Ethanol	9 (0.2%)
Stimulants	17 (0.4%)
Hallucinogens	5 (0.1%)
Benzodiazepine	19 (0.5%)
Salicylates	1 (<0.1%)
Acetaminophen	6 (0.1%)

¹ *International Classification of Diseases Tenth Revision* [ICD-10] codes used to determine co-diagnoses are shown in the Supplement.

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