Rising Inpatient Utilization and Cost of Cannabis Hyperemesis Syndrome Hospitalizations in Massachusetts Following Legalization

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Goal

We aimed to describe the demographics, inpatient utilization, and cost of services among patients hospitalized for cannabis hyperemesis syndrome (CHS) overall as well as predating and postdating cannabis legalization in Massachusetts (MA)

Introduction

- CHS is increasingly recognized as a pattern of cyclical vomiting in chronic cannabis users
- This syndrome been classified by the Rome IV committee as a subset of patients with nausea and vomiting disorders who demonstrate:
  (1) stereotypical episodic vomiting resembling cyclical vomiting syndrome in terms of onset, duration and frequency
  (2) presentation after prolonged use of cannabis
  (3) relief of vomiting by sustained cessation of cannabis use[1,2]
- Patients often undergo repeated visits to clinic, emergency department, and inpatient setting[4]
- Course of patients hospitalized for CHS and their associated costs are unknown[5]
- Few studies have examined shifts in CHS presentation and costs pre- and post- cannabis legalization

Methods and Materials

Patient Selection

- Retrospective cohort study (Tufts IRB: STUDY00001804) of patients 18-80 admitted to Tufts Medical Center in Boston MA with likely CHS, between 1/1/2012 and 6/1/2021
- Reviewed all inpatients with ICD-9 or ICD-10 codes related to persistent vomiting who also had a cannabis-related ICD code billed at least once during any prior hospitalization
- Excluded if alternate diagnosis for emesis found via chart review

Methods and Materials Continued

Primary analyses

- Comparative analysis of demographics between patients admitted pre- and post- legalization including age, gender, cannabis type used, and frequency of use
- Comparative analysis of hospital services used pre- and post- legalization including length of stay, lab services, antiemetics, intravenous fluids, endoscopies, imaging, GI consulting services and ICU- level care requirements

Exploratory analyses

- Estimated cost of inpatient services pre- and post-legalization for patients admitted to Tufts Medical Center for a diagnosis of CHS using hospital billing records
- Association between legalization status with length of stay and total cost, controlling for age and gender

Results

Summary of **Table 1** (not pictured):

- N=63 patients hospitalized for CHS with total of 72 hospital admissions; mean age (SD) was 33.3 (11.7) and 52.3% identified as female
- Mean (SD) inpatient length of stay was 2.8 (2.5) days
- Basic metabolic panel, antiemetics, and intravenous fluids were ordered for mean (SD) of 2.1 (1.9), 2.5 (1.5), and 1.7 (1.2) days respectively. 47% of admissions recorded a positive urine toxicology screen for cannabis
- Upper endoscopy was performed in 19.4% of admissions and gastroenterology was consulted in 43.1% of admissions
- Imaging was performed in 76.3% of admissions with abdominal plain films ordered most frequently
- Intensive care was required in 12.5% of admissions.

Results Continued

Table 2: Demographics, Cannabis Exposure and Utilization of Inpatient Services Pre vs. Post Cannabis Legalization

Demographics	Pre-Legalization (n= 12 patients)	Post-Legalization (n=51 patients)	p-value*
Number of hospital admissions	15	57	--
Female gender	4 (33.3)	29 (50.9)	0.25
Age	35.5 (11.5)	32.9 (13.5)	0.32
Cannabis type used	--	--	--
Smoking	6 (50.0)	31 (60.8)	0.53
Vaping	0	2 (3.9)	--
Edibles	0	2 (3.9)	--
More than one type	0	1 (2.0)	--
Not reported	6 (50.0)	15 (29.4)	--
Cannabis use frequency			
Less than daily	0	9 (17.6)	0.19
At least daily	3 (25.0)	24 (47.1)	0.21
Multiple times daily	3 (25.0)	8 (15.7)	0.42
Unknown	6 (50.0)	10 (19.6)	--
Utilization of Services	**Pre-Legalization (n=15 hospitalizations)**	**Post-Legalization (n=57 hospitalizations)**	**p-value***
Urine toxicology testing	--	--	--
Positive	10 (66.7)	37 (64.9)	1.0
Not performed	4 (26.7)	16 (28.1)	--
Negative	1 (6.7)	4 (7.0)	--
Length of inpatient stay, days	1.4 (0.91)	3.2 (2.6)	**<0.005**
Basic metabolic panel, days	1.9 (1.3)	2.1 (2.0)	0.79
Antiemetics, days	1.6 (1.1)	2.7 (1.5)	**<0.05**
Intravenous fluids, days	1.3 (0.72)	1.8 (1.2)	0.32
Endoscopies performed	3 (20.0)	14 (24.5)	1.0
Imaging studies performed	12 (80.0)	43 (75.4)	1.0
GI consults or GI admit	5 (33.3)	26 (45.6)	0.57
ICU-level care	0.0	9 (15.8)	0.19

Mean and standard deviation are displayed for continuous variables; n and % are displayed for categorical variables. Chi square was used for categorical variables and t-test for continuous variables.
*Sig defined as p<0.05

Discussion Points

- Patient demographics were similar pre vs post legalization
- Cannabis legalization in Massachusetts was associated with a significantly increased length of hospital stay per patient (3 days vs 1 day, p<0.005)

Results Continued

Table 3: Mean charges by service per hospital stay (n=72 hospitalizations)

	Overall (n=72)	Pre-legalization (n=12)	Post-legalization (n=53)	p-value*
Mean inpatient charges	$16,636	$7460	$18.714	**<0.0005**
Basic metabolic panel charges	$970	$621	$1045	0.08
Anti-emetic charges	$61	$38	$66	0.44
IVF charges	$707	$551	$745	**<0.05**
Endoscopy charges	$2106	$1512	$2360	**<0.05**
Imaging charges	$1900	$1323	$2085	0.29

Mean costs are rounded to the nearest dollar.
*T-tests or Mann-Whitney U test was performed with significance defined as p< 0.05.

Table 4: Multivariate linear regression of clinical covariates and length of stay and total cost

Length of stay

Covariate	B-statistic	p-value*	Confidence Interval
Age	0	0.92	[0-0.05]
Gender	-0.38	0.51	[-1.53-0.77]
Admission post-leg	1.7	**0.02**	[0.33-3.14]

Total cost

Covariate	B-statistic	p-value	Confidence Interval
Age	74.1	0.22	[-187.1-335.27]
Gender	-3999.7	0.20	[-10,171.48-2172.13]
Admission post-leg	10,131.25	**0.02**	[1686.34-18576.17]

Multivariate linear regression was used to evaluate the association between legalization status with length of stay and total cost, controlling for age and gender.
*Significance defined as p<0.05

Discussion Points

- The cost of CHS admissions per hospitalization increased by 151% post legalization
- Admission during post-legalization was an independent risk factor for both increased length of stay and increased cost of hospitalization

Conclusion

In the post-legalization era of cannabis in Massachusetts, we found increased CHS hospitalizations, with increased length of hospital stay and total cost per hospitalization. As cannabis use increases, the recognition and costs of its effects are necessary to incorporate into future clinical practice strategies and health policy.

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