Cannabinoid Use and Their Implications in Anesthesia & Surgery

George Williams, MD, FASA, FCCM, FCCP

Professor and Vice Chair for Critical Care Medicine

Department of Anesthesiology, Critical Care and Pain Medicine & Surgery

UTHealth The University of Texas Health Science Center at Houston | McGovern Medical School

Disclosures

CSTS ARDS Grant Co-PI

Sedena Medical® PI

Objectives

Analyze the implications of marijuana use in anesthesia and surgery

Discerning effects of cannabinoids on the increased dosage requirements of anesthetics

Evaluate postoperative complications and strategizing effective pain management amidst marijuana consumption in the perioperative setting

Optimize patient care and safety in the perioperative setting

Cannabinoids

18% US incidence / 3.8% worldwide

30% CUD

11 States with legalization

CUD

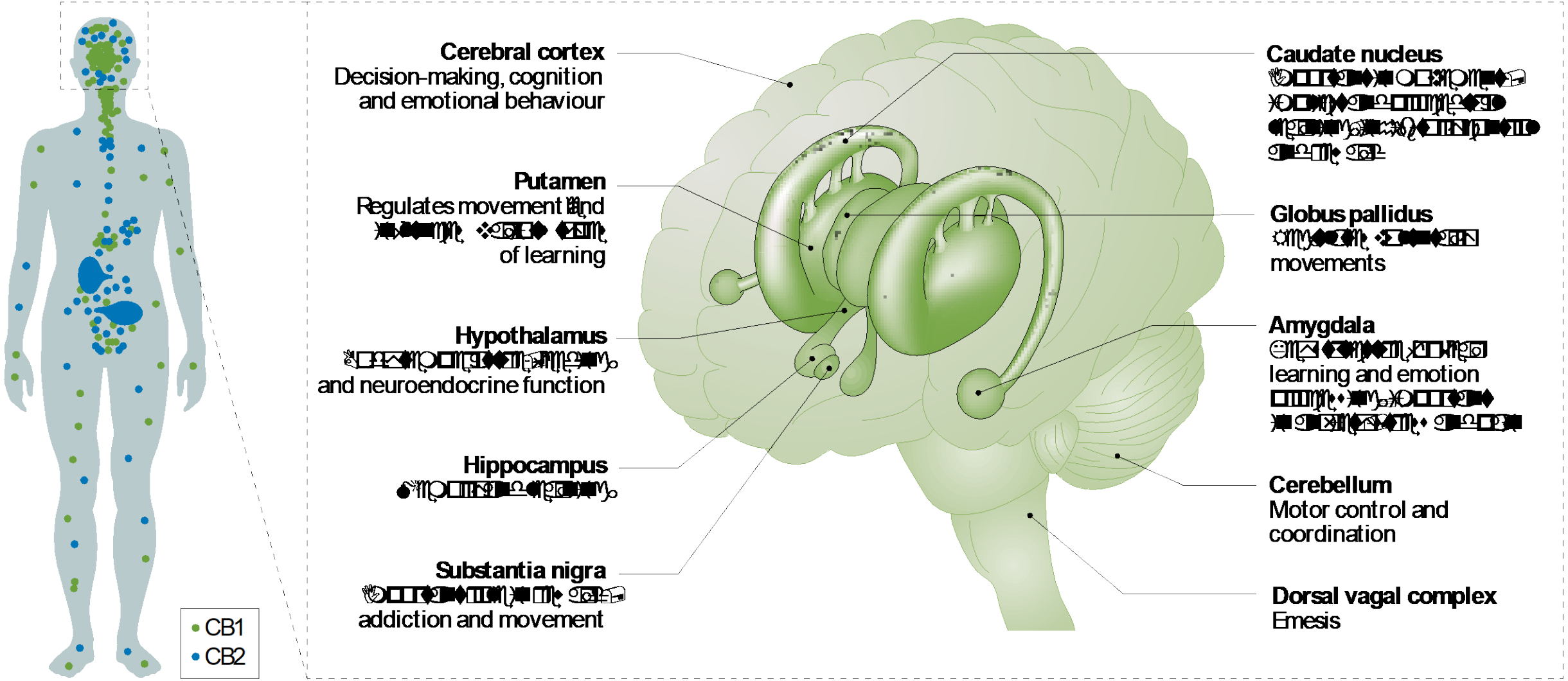
Mixed data

Receptor Physiology

CB1-R, CB2-R

Cannabinol & Δ8-tetrahydrocannabinol (D8-THC)

Echeverria-Villalobos M, Todeschini AB, Stoicea N, Fiorda-Diaz J, Weaver T, Bergese SD. Perioperative care of cannabis users: A comprehensive review of pharmacological and anesthetic considerations. *J Clin Anesth*. 2019;57:41-49.



Connor JP, Stjepanović D, Le Foll B, Hoch E, Budney AJ, Hall WD. Cannabis use and cannabis use disorder. *Nat Rev Dis Primers*. 2021;7(1):16. Published 2021 Feb 25.

CB1-R

New Users

initial β-adrenergic effect + parasympathetic inhibition
→ NE

Chronic Users

Strong parasympathetic response + baroreflexes deregulation

Coronary spasm in patients with coronary disease → MI
MI (↑ MVO2, ↑ COHb, and coronary thrombosis)

Mesenteric vasodilation

CB1-R

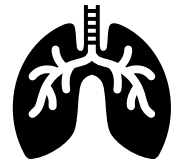
New User

Vasodilation and ↑CBF

Chronic User

Cerebral vasospasm → ischemic stroke (posterior cerebral circulation affected ½ of cases)

CB1-R



Chronic User

Bronchial tone → hyperreactivity

Pharyngeal & uvular edema → upper airway obstruction

DAH, necrotizing bronchiolitis → edema

Pulmonary embolism (more common with synthetics)

CB1-R

Altered central thermoregulation

→ intraoperative hypothermia

→ severe postoperative shivering

Increased clotting time

Decreased platelet count

Increased risk of bleeding in patients taking warfarin

Anesthetics

Prolongs THP, Ketamine

Antagonized propofol

γ-aminobutyric acid

COX inhibition

Prolonged NMB?

Cannabinoid hyperemesis syndrome

NIS

Largest longitudinal database in the US

7 million patients

→ 35 million represented

Age, race, total charges, hospital characteristics (teaching status, location), $$, location, hospital size, admission day, %discharge disposition, and 25 diagnostic and 15 procedural ICD-9 codes and more…

ICD-10 added in Oct 2015

KID

Pediatric version of NIS

2-3 million/year

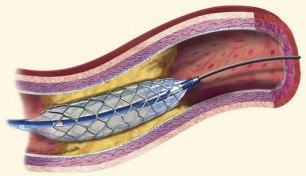
→ 7 million represented

1997-2012

- 22 states in 1997
- 44 states in 2012
- 48 states + DC in 2019

CENTRAL ILLUSTRATION: Study Flow Diagram and Adjusted Odds Ratios of In-Hospital Outcomes After Percutaneous Coronary Intervention in Patients With or Without Reported Marijuana Use

Study Flow Diagram



Total PCIs
January 2013-October 2016
N = 113,477

Before matching

Reported Marijuana Use
n = 3,970

No Reported Marijuana Use
n = 109,507

After matching and exclusions

Reported Marijuana Use
n = 3,803

No Reported Marijuana Use
n = 3,803

Post-PCI In-hospital Outcomes

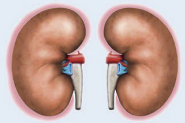
Reported marijuana use was associated with:

Higher Risk

Bleeding
Adjusted odds ratio 1.54
(95% CI: 1.20-1.97)

Stroke
Adjusted odds ratio 11.01
(95% CI: 1.32-91.67)

Lower Risk



Acute Kidney Injury
Adjusted odds ratio 0.61
(95% CI: 0.42-0.87)

No Significant Difference in Risk

Transfusion
Adjusted odds ratio 1.00
(95% CI: 0.69-1.44)

Death
Adjusted odds ratio 0.94
(95% CI: 0.54-1.62)

Yoo, S.G.K. et al. J Am Coll Cardiol Intv. 2021;14(16):1757–1767.

Medical Complications Assessed	CUD (%)	Controls (%)	OR	95% CI	*P* Value[a]
Pneumonia	4.11	0.99	2.41	2.08-2.80	<0.0001
Respiratory failures	1.49	0.35	2.23	1.75-2.85	<0.0001
Myocardial infarctions	0.73	0.19	2.13	1.51-2.99	<0.0001
Ileus	0.69	0.24	1.97	1.41-2.75	<0.0001
Cerebrovascular accidents	1.00	0.32	1.90	1.44-2.52	<0.0001
Acute kidney injuries	4.78	1.47	1.66	1.45-1.89	<0.0001
Urinary tract infections	6.50	2.96	1.52	1.37-1.70	<0.0001
Transfusion of blood products	2.20	1.08	1.26	1.06-1.50	<0.0001
Venous thromboemboli	3.32	2.28	1.03	0.91-1.19	0.579
Deep vein thromboses	2.19	1.69	1.01	0.85-1.19	0.895
Pulmonary emboli	1.05	0.92	0.62	0.49-0.78	<0.0001
Total medical complications	28.08	12.5	1.50	1.40-1.61	<0.0001

Weisberg MD, Ng MK, Magruder ML, Vakharia RM, Roche MW, Erez O. The Association of Cannabis Use Disorder and Perioperative Complications After Primary Total Knee Arthroplasty. *J Am Acad Orthop Surg*. 2022;30(7):313-320.

TABLE 2. Peri- and Postoperative Outcomes and Complications

Characteristics	Cannabis Use (N = 2184)	No Cannabis Use (N = 2184)	OR (95% CI)	*P*
In-hospital mortality, all-cause, N (%)	7 (0.3)	2 (0.09)	3.5 (0.7–34.6)	0.095
Discharge disposition, N (%)				0.001
Home/routine	1432 (65.6)	1461 (66.9)	0.9 (0.8–1.1)	
Transfer to short-term hospital	35 (1.6)	21 (1.0)	1.7 (1.0–2.9)	
Skilled nursing/rehabilitation facility	461 (21.1)	379 (17.4)	1.3 (1.1–1.5)	
Home health care	232 (10.6)	304 (13.9)	0.7 (0.6–0.9)	
Against medical advice	16 (0.7)	16 (0.7)	1.0 (0.5–2.0)	
Length of stay, days, mean (SD)	7.1 (10.3)	5.2 (7.9)	—	<0.001
Hospital charges, USD, mean (SD)	137,631.30 (145,286.50)	116,112.60 (122,147.80)	—	<0.001
Complications, N (%)				
Acute kidney injury	56 (2.6)	44 (2.0)	1.3 (0.8–2.0)	0.225
Respiratory complications	102 (4.7)	51 (2.3)	2.0 (1.4–2.9)	<0.001
Thromboembolic events	41 (1.9)	19 (0.9)	2.2 (1.2–4.0)	0.005
Septicemia/sepsis	60 (2.7)	38 (1.7)	1.5 (1.0–2.5)	0.031
Myocardial infarction	7 (0.3)	5 (0.2)	1.4 (0.4–5.6)	0.774
Neurologic complications	23 (1.1)	8 (0.3)	2.9 (1.2–7.5)	0.007

CI indicates confidence interval; OR, odds ratio; SD, standard deviation.

Chiu RG, Patel S, Siddiqui N, Nunna RS, Mehta AI. Cannabis Abuse and Perioperative Complications Following Inpatient Spine Surgery in the United States. *Spine (Phila Pa 1976)*. 2021;46(11):734-743.

No Δ

Chiu RG, Fuentes AM, Patil SN, Chiu R, McGuire LS, Mehta AI. Cannabis Abuse and Perioperative Complications After Treatment of Intracranial Aneurysms: A Nationwide Analysis. *World Neurosurg*. 2022;158:e184-e195.

Table III. Adjusted Analysis of postoperative outcomes between CUD and Non-CUD patients in propensity-matched cohorts[a]

	Unadjusted analyses				Adjusted analyses			
	CUD*N* = 972	Non-CUD*N* = 189,822	OR (95% CI)	*P* value	CUD*N* = 972	Non-CUD*N* = 972	OR (95% CI)	*P* value
Postoperative Complications								
Cardiac Complications	33 (3.4)	7,714 (4.1)	0.83 (0.59–1.17)	0.292	33 (3.4)	19 (2.0)	1.76 (0.99–3.12)	0.0491
Respiratory Complications	50 (5.1)	10,704 (5.6)	0.91 (0.68–1.21)	0.5045	50 (5.1)	47 (4.8)	1.07 (0.71–1.61)	0.7547
Sepsis	35 (3.6)	5,080 (2.7)	1.35 (0.97–1.91)	0.0751	35 (3.6)	25 (2.6)	1.41 (0.84–2.38)	0.1897
Infection	16 (1.6)	3,172 (1.7)	0.98 (0.60–1.62)	0.9517	16 (1.6)	17 (1.7)	0.94 (0.47–1.87)	0.8606
AKI	99 (10.2)	16,577 (8.7)	1.19 (0.96–1.46)	0.1098	99 (10.2)	68 (7.0)	1.51 (1.09–2.08)	0.0121
CVA	72 (7.4)	16,280 (8.6)	0.85 (0.67–1.08)	0.194	72 (7.4)	73 (7.5)	0.98 (0.70–1.38)	0.9312
VTE	25 (2.6)	2,904 (1.5)	1.69 (1.14–2.53)	0.0084	25 (2.6)	16 (1.6)	1.58 (0.84–2.97)	0.1554
Major Amputations	46 (4.7)	6,835 (3.6)	1.33 (0.98–1.79)	0.0591	46 (4.7)	51 (5.2)	0.90 (0.59–1.35)	0.6025
Mortality	10 (1.0)	3,749 (2.0)	0.52 (0.28–0.96)	0.0347	10 (1.0)	8 (0.8)	1.25 (0.49–3.19)	0.6358
Total Charges, ($) Median, (IQR 1–3)	115,873.1 ((108,062.9–123,683.2)	92,778.4 (92,310.5–93,246.2)	-	<0.001	115,873.1 (108,062.9–123,683.2)	92,539.3 (86,924.2-98,154.5)	-	<0.001
Length of Stay, (days) mean ± SD	8.25 ± 7.47	7.12 ± 8.08	-	<0.001	8.25 ± 7.47	6.33 ± 6.14	-	<0.001

OR, Odds Ratio; CI, Confidence Interval; BMI, Body Mass Index.

[a] All values *n* (%) unless otherwise stated.

	Unadjusted analyses				Adjusted analyses			
	CUD (n = 2344) (%)	No CUD (n = 507,725) (%)	Crude OR (95% CI) (CUD vs no CUD)	*P* value	CUD (n = 2342) (%)	No CUD (n = 2342) (%)	Adjusted OR (95% CI) (CUD vs no CUD	*P* value
MI	77 (3.3)	12,400 (2.4)	1.36 (1.08-1.71)	.0084	77 (3.3)	50 (2.1)	1.56 (1.09-2.24)	.016
Respiratory failure	198 (8.5)	30,769 (6.1)	1.43 (1.24-1.66)	<.001	197 (8.4)	202 (8.6)	0.97 (0.79-1.20)	.79
Acute kidney injury	242 (10.3)	39,717 (7.8)	1.36 (1.19-1.55)	<.001	241 (10.3)	222 (9.5)	1.10 (0.90-1.33)	.35
VTE	124 (5.3)	17,262 (3.4)	1.59 (1.32-1.90)	<.001	124 (5.3)	159 (6.8)	0.77 (0.60-0.98)	.032
Sepsis	77 (3.3)	18,827 (3.7)	0.88 (0.70-1.10)	.2797	77 (3.3)	119 (5.1)	0.64 (0.47-0.85)	.002
Stroke	128 (5.5)	14,015 (2.8)	2.04 (1.70-2.44)	<.001	128 (5.5)	82 (3.5)	1.59 (1.20-2.12)	.001
Mortality[a]	28 (1.2)	8813 (1.7)	0.69 (0.47-1.00)	.0481	28 (1.2)	40 (1.7)	0.70 (0.43-1.13)	.146

CI, Confidence interval; MI, myocardial infarction; *OR*, odds ratio; *VTE*, venous thromboembolism.
Survey weights were not used in this analysis. Significance defined as $P < .05$ for the primary outcome and $P < .006$ for the secondary outcomes. Values are number (%).
[a]Mortality data were missing for 202 patients in the unmatched cohort and 6 patients in the matched cohort.

McGuinness B, Goel A, Elias F, Rapanos T, Mittleman MA, Ladha KS. Cannabis use disorder and perioperative outcomes in vascular surgery. *J Vasc Surg*. 2021;73(4):1376-1387.e3.

Potnuru et al

January 2016 to December 2019

Coding population unique

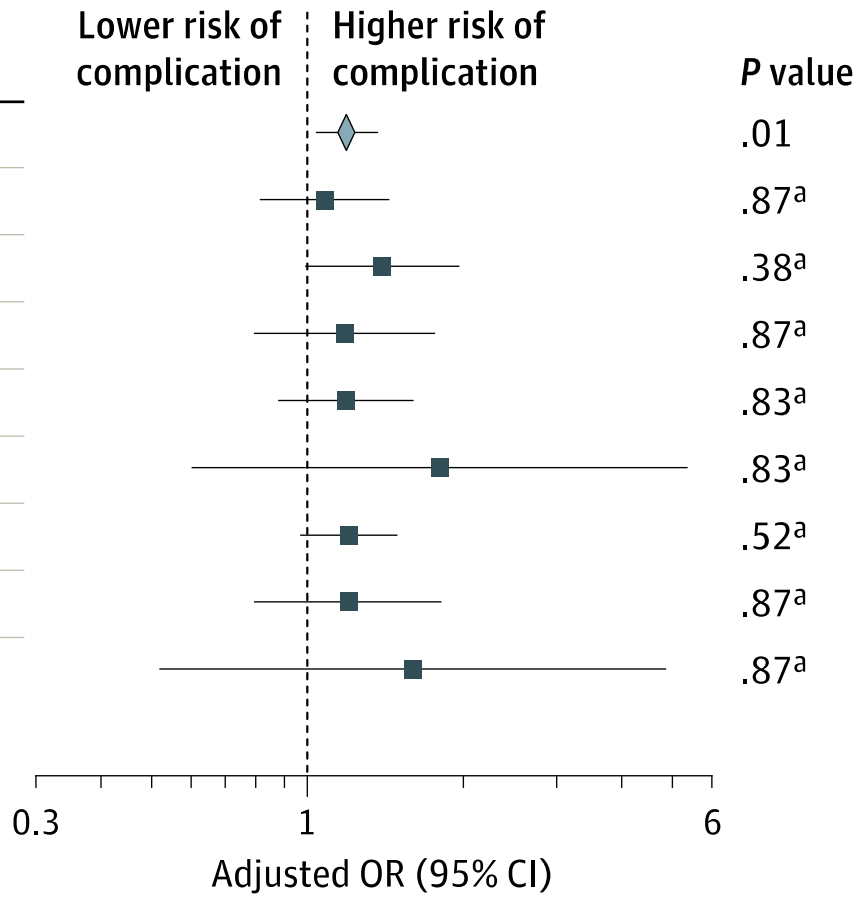
myocardial ischemia, acute kidney injury, stroke, respiratory failure, venous thromboembolism, hospital-acquired infection, and surgical procedure–related complications

2,848,4087 → 2,393,989 → 811,270 → 6,211 (PSM)

Potnuru PP, Jonna S, Williams GW 2nd. Cannabis Use Disorder and Perioperative Complications. *JAMA Surg*. 2023;158(9):935-944

Figure 2. Analysis of the Association of Cannabis Use Disorder With Perioperative Complications After Major Elective Inpatient Surgery

Outcome	Cannabis use disorder, No. (%)		Adjusted OR (95% CI)	*P* value
	With	Without		
Composite	480 (7.73)	408 (6.57)	1.19 (1.04-1.37)	.01
Myocardial ischemia	96 (1.55)	89 (1.43)	1.08 (0.81-1.44)	.87[a]
Acute kidney injury	79 (1.27)	57 (0.92)	1.39 (0.99-1.96)	.38[a]
Stroke	53 (0.85)	45 (0.72)	1.18 (0.79-1.76)	.87[a]
Respiratory complication	96 (1.55)	81 (1.30)	1.19 (0.88-1.60)	.83[a]
Venous thromboembolism	9 (0.14)	5 (0.08)	1.80 (0.60-5.38)	.83[a]
Infection	186 (2.99)	156 (2.51)	1.20 (0.97-1.49)	.52[a]
Surgical complication	49 (0.79)	41 (0.66)	1.20 (0.79-1.81)	.87[a]
In-hospital mortality	8 (0.13)	5 (0.08)	1.60 (0.52-4.89)	.87[a]



Conclusions

CUD is growing

Cannabinoids do affect anesthetic management

Administration type may further exacerbate outcome challenges