

No Correlation Between Ketamine Administered on Day of Surgery and Neurological Complications for Traumatic Brain Injury Patients

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Key Findings:

- Patients who received ketamine on the day of surgery for a traumatic brain injury (TBI) had no statistically significant change in the risk of death during hospitalization or in the risk of developing attention deficit disorder, seizures, or paralysis in the six months after surgery.

Traumatic brain injury (TBI) is a type of brain damage caused by an external force, such as an impact or penetrating injury to the head.¹ Severe cases can result in death or long-term neurological impairment.² Ketamine is sometimes used in patients with TBIs to maintain blood pressure, control agitation or seizures, or as a sedative.^{3,4} However, there have been previous concerns that ketamine might raise intracranial pressure, which could be detrimental to patients with TBIs.^{4,5} This study aimed to evaluate the relationship between ketamine administration during hospitalization for surgically treated TBI and in-hospital death or severe neurological impairment.

We studied 21,888 adult patients who underwent surgical treatment for TBI, such as a craniotomy, hematoma evacuation, or skull fracture repair, between 2010 and 2025 and compared outcomes for patients who received ketamine on the same day as their surgery and those who did not. We accounted for patient age, sex, race, ethnicity, socioeconomic vulnerability, TBI category, and emergency department acuity level.

We found no significant difference in the likelihood of developing paralysis, seizures, or attention deficit disorder in the six months following surgery, and no significant difference in the likelihood of in-hospital death between patients who received ketamine on the day of surgery and those who did not.

Likelihood of Severe Neurological Complications or Death by Ketamine Administration

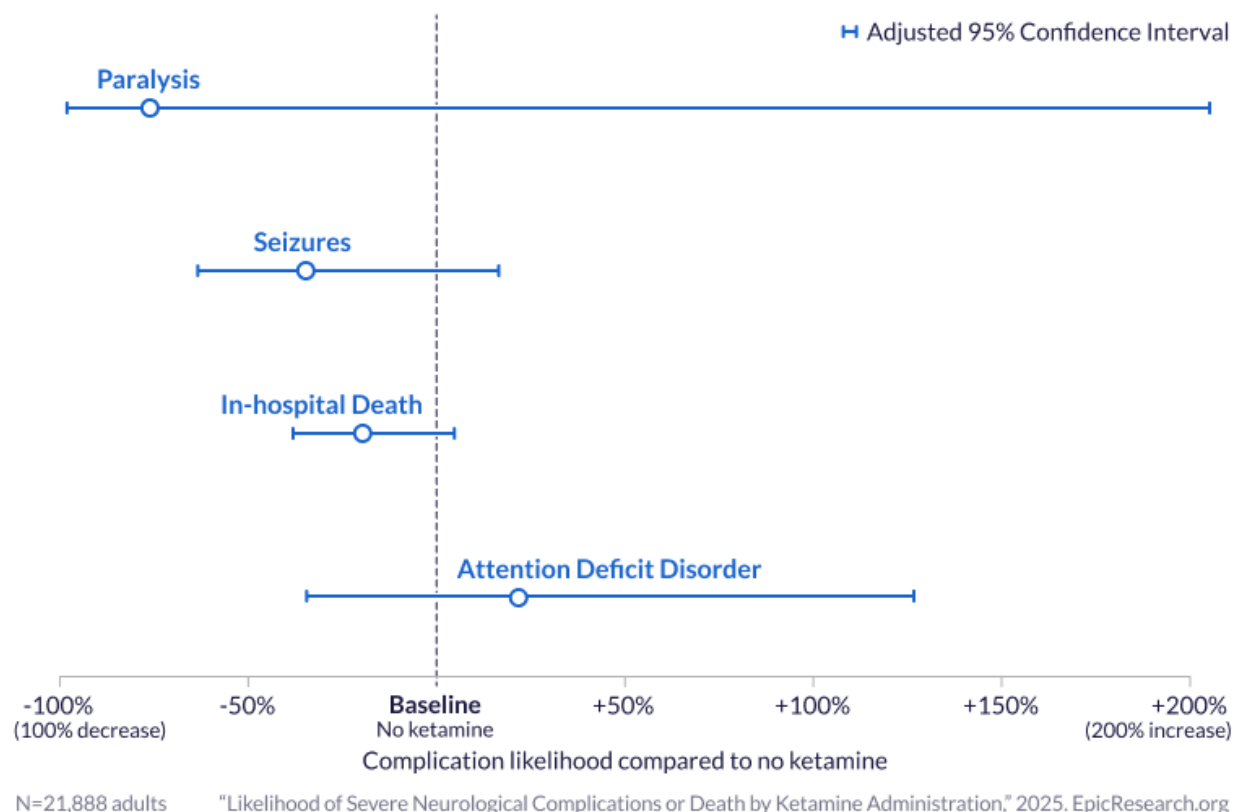


Figure 1. The likelihood of a patient with a TBI experiencing severe neurological complications by ketamine administration on the day of surgery. Confidence intervals that cross the baseline likelihood indicate that the observed change in likelihood might be due to random chance.

These data come from Cosmos, a dataset created in collaboration with a community of Epic health systems representing more than 296 million patient records from 1,600 hospitals and more than 39,000 clinics from all 50 states, Lebanon, and Saudi Arabia. This study was completed by two teams that worked independently, each composed of a clinician and research scientists. The two teams came to similar conclusions. Graphics by Brian Olson.

References

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Data Definitions

Term	Definition
Study period	1/1/2010 to 12/15/2024
Study population - inclusion	Patients with: • Their first traumatic brain injury admission or ED visit • Evidence of a TBI-related surgical procedure on the first or second day of their encounter • A face-to-face encounter at least six months prior to the admission • A face-to-face encounter at least six months after the admission (not required for the death outcome)
Study population – exclusions	Patients with: • A history of cognitive issues • Ketamine administered after the day of their TBI-related surgical procedure
Exposures	Ketamine: A medication administration with RxNorm code 6130
Outcomes	Death during the encounter or one of the following conditions in the six months after the admission date: • Attention deficit: ICD-10-CM code R56.1 or R41.840 • Seizures: ICD-10-CM code G40* • Paralysis: ICD-10-CM code G82*
Model specifications	Logistic regression with the following adjustments: • Age (18-34, 35-49, 50-64, 65+) • Legal sex • Category of TBI: The sub-code(s) of S06* documented on the encounter • ED acuity level: 1, 2, 3, 4, 5, unknown, or none • Race and ethnicity • Social Vulnerability Index quintile
Traumatic brain injury	A diagnosis with ICD-10-CM code S06* or SNOMED code 127295002
TBI-related surgical procedure	Craniotomies: CPT code 61304, 61305, 61312, 61313, 61314, 61315 Hematoma evacuations: CPT code 61106, 61107, 61108, 61154, 61312, 61313, 61314, 61315 Skull fracture repair: CPT code 62000, 62005, 62010
Face-to-face encounter	An encounter with a type of Emergency, Office visit, Well Child, Follow-Up, Telemedicine, Urgent care, Walk-In, or Hospital Encounter
Cognitive issues	Alzheimer's/dementia: ICD-10-CM code F01*-F03*, or G30* Brain tumor: ICD-10-CM code C71* Stroke: ICD-10-CM code I63* Depression: ICD-10-CM code F30*-F33*, or F34.1 Anxiety: ICD-10-CM code F40*-F41*, F06.4, F93.0, or F94.0
Race and ethnicity	Patients were classified by reported race and ethnicity as Hispanic or non-Hispanic and Black or non-Black
Social Vulnerability Index	The social vulnerability quintile for the ZIP Code of the patient's most recent address

Table 1: Likelihood of Severe Neurological Complications or Death by Ketamine Administration

Condition	Odds Ratio	Lower CI	Upper CI
Paralysis	0.24	0.02	3.05
Seizures	0.65	0.37	1.16
In-hospital Death	0.81	0.62	1.05
Attention Deficit Disorder	1.22	0.66	2.27