Ketamine Induced Generalized Convulsive Seizure in a Healthy 6-Year-Old Male Undergoing Procedural Sedation

Moza Al Noaimi, MB BCh BAO, SBEM* Shaibaz Hussain, MBBS, MRCP**
Ghada Al Qassim, MD, SSC-P, SSC-PEM***

It is not clear whether Ketamine has proconvulsant or anticonvulsant characteristics. Some studies claim that it possess anticonvulsant neuroprotective qualities, others found that Ketamine caused seizures ranging from epileptiform activity on EEGs to generalized motor seizures in epileptic patients.

We report a case of a healthy six-year-old male who underwent Ketamine procedural sedation and developed a generalized tonic-clonic seizure which was aborted by benzodiazepine.

Bahrain Med Bull 2020; 42 (1): 79 - 80

Ketamine has been in clinical use since 1965 as a general anesthetic for human and veterinary service with an excellent medical safety profile[1]. Ketamine's favorable clinical features made it popular and versatile beyond its initial role as an anesthetic into the fields of Intensive Care Unit (ICU), emergency medicine, palliative medicine, and prehospital settings, for acute and chronic pain management, procedural sedation, and asthma treatment[2].

Ketamine has a broad range of positive pharmacological actions including stimulation of the cardiovascular system, maintenance of the respiratory drive, bronchodilation, catalepsy, sedation, amnesia, and analgesia[2]. Studies regarding the convulsant potential of Ketamine are unclear. Some authors negate the association between Ketamine and convulsions in healthy and epilepsy patients; others claim anticonvulsant and neuroprotective properties and is used as an effective third-line medication for treating refractory status epilepticus; others claim that Ketamine caused seizures ranging from epileptiform activity to generalized motor seizures in epilepsy patients on EEGs[3-8]. Conflicting evidence has also been observed in multiple animal studies[1,9,10,11].

To our knowledge, there are only two case reports that describe Ketamine-induced seizures in healthy subjects, both in the pediatric population[12,13].

The aim of this presentation is to report a rare and unexpected side effect of Ketamine in the usual dose used for procedural sedation.

THE CASE

A healthy six-years-and-ten-months-old male, having no documented alerts, no known allergies and no active problems, presented with history of a fall on his chin from a bicycle. He sustained a cut wound on the chin and trauma to one tooth.

The vital signs were as follows: temperature 36.4 ○C oral, BP 92/58 mmHg, HR: 112 bpm, RR 22 breaths/min, SpO2 97% on RA, and weight 24.5 kg.

He was comfortable, not distressed, and his general physical examination was normal except for a deep lacerated wound on his chin/mandible, which measured approximately 2 cm long, and fractured right upper molar tooth with exposed pulp.

Wound suturing was advised under sedation. Ketamine (20 mg IV, which was slightly less than 1 mg/kg) was administered. After dissociation, and while suturing, the patient suddenly developed twitches and stiffness followed by bilateral symmetrical rhythmic jerky tonic-clonic movements, more in the upper limb with up-rolling of eyeballs. He was on oxygen and attention to his airway was maintained, hypoxia and hypoglycemia were ruled out. The seizure lasted for about 30 seconds before it was terminated by an injection of Midazolam (2 mg IV).

Suturing was completed and the parents were informed about the incident. They verified a negative history or family history of seizure disorders.

The patient was kept for observation until he was fully awake and tolerated oral intake. Postoperative period was uneventful and he was discharged in a stable condition. Follow-up of the patient up to nine months revealed no recurrence of seizures.

DISCUSSION

Some anesthetic agents demonstrate both proconvulsant and anticonvulsant effects. One potential reason is the biological variability from an individual to another in the sensitivity to the drug and in the pharmacodynamic effects on the central nervous system targeting inhibitory and excitatory tissues. Another potential reason is that some drugs exist as asymmetric

* Senior Resident
** Senior Resident
*** Consultant Pediatrician
Department of Emergency Medicine
Bahrain Defence Force – Royal Medical Services
Kingdom of Bahrain
E-mail: m_alnuaimi_08@hotmail.com

molecules called enantiomers. This slight variation in the structure may modify the drug's affinity for a certain receptor binding site and produce different effects for each enantiomer[14].

Ketamine is a non-competitive antagonist of the excitatory amino acid N-methyl-d-aspartate glutamate receptor, which may explain the mechanism of its anticonvulsant property. Conversely, the proconvulsant property might be in part due to the existence of a chiral center in the molecule with two enantiomers found: the S (+) more potent isomer of Ketamine, which causes epileptic activity suppression on electroencephalogram tests, and the R (-) less potent isomer, which is not capable of providing a similar degree of suppression[6,10]. Other factors or mechanisms may play a role, but they remain unknown. In our case, there were no identifiable risk factors for the seizure except the administration of Ketamine, which based on previous studies, is a rare occurrence.

CONCLUSION

Proconvulsant potential of Ketamine remains unclear, a few cases reported the association between Ketamine administration and convulsions in healthy individuals. Previous studies caution the use of Ketamine in epileptic patients. We suggest that there is a remote possibility of an association between Ketamine and seizures in healthy individuals.

Author Contribution: All authors share equal effort contribution towards (1) substantial contributions to conception and design, analysis and interpretation of data; (2) drafting the article and revising it critically for important intellectual content; and (3) final approval of the manuscript version to be published. Yes.

Potential Conflicts of Interest: None.

Competing Interest: None.

Sponsor Ship: None.

Acceptance Date: 16 November 2019.

Ethical Approval: Approved by the Research Ethics Committee of the Royal Medical Services at Bahrain Defence Force Hospital.

REFERENCES

1. Dorandeu F, Dhote F, Barbier L, et al. Treatment of Status Epilepticus with Ketamine, Are We There Yet? CNS Neurosci Ther 2013; 19(6): 411–427.
2. Kurdi MS, Theerth KA, Deva RS. Ketamine: Current Applications in Anesthesia. Pain, and Critical Care, Anesth Essays Res 2014; 8(3): 283–290.
3. Modica PA, Tempelhoff R, White PF. Ketamine and Epilepsy. Anesth Analg 1990; 70(4):433-44.
4. Celesia GG, Chen RC, Bamforth BJ. Effects of Ketamine in Epilepsy. Neurology 1975; 25:169–172.
5. Khanna N, Bhalla S. Role of Ketamine in Convulsions. Indian J Med Sci 1999; 53(11):475-80.
6. Rosati A, De Masi S, Guerrini R. Ketamine for Refractory Status Epilepticus: A Systematic Review. CNS Drugs 2018; 32(11):997-1009.
7. Ferrer-Allado T, Brechner VL, Dymond A, et al. Ketamine Induced Electroconvulsive Phenomena in the Human Limbic and Thalamic Regions. Anesthesiology 1973; 38:333–344.
8. Bennett DR, Madsen JA, Jordan WS, et al. Ketamine Anesthesia in Brain Damaged Epileptics. Neurology 1973; 23:449–460.
9. Gourie-Devi M, Cherian L, Shankar SK. Seizures in Cats Induced by Ketamine Hydrochloride anaesthesia – A Preliminary Report. Indian J Med Res 1983; 77:525–8.
10. Sofia RD, Gordan R, Gels M, et al. Comparative Effect of Felbamate and Other Compounds on N-Methyl-D-Aspartic Acid-Induced Convulsions and Lethality in Mice. Pharmacol Res 1994; 29:139-44.
11. Christe KL, Lee UJ, Lemoy MJ, et al. Generalized Seizure Activity in an Adult Rhesus Macaque (Macaca Mulatta) During Ketamine Anesthesia and Urodynamic Studies Comp Med 2013; 63(5): 445–447.
12. Khandrani J, Rajput A, Dahake S, et al. Ketamine Induced Seizures. The Internet Journal of Anesthesiology 2008; 19(1).
13. Kurdi MS, Sushma KS, Ranjana R, et al. Ketamine: A Convulsant? Anesth Essays Res 2017; 11(1): 272–273.
14. Modica PA, Tempelhoff R, White PF. Pro- and Anticonvulsant Effects of Anesthetics (Part II). Anesth Analg 1990; 70(4):433-44.