Ketamine-induced muscle rigidity during procedural sedation mitigated by intravenous midazolam

Case Report

Ketamine-induced muscle rigidity during procedural sedation mitigated by intravenous midazolam

Abstract

Ketamine is becoming increasingly popular among emergency providers for procedural sedation. This case report describes a rare side effect of ketamine and the novel use of benzodiazepine to mitigate the effect. During procedural sedation for reduction of an ankle fracture-dislocation, bilateral lower extremity muscle rigidity occurred following administration of ketamine, which was mitigated by intravenous midazolam. Muscle rigidity is a rare yet potentially serious side-effect of ketamine of which emergency providers should be aware. The use of IV benzodiazepines was a novel way to mitigate the effect.

Ketamine is a dissociative sedative commonly utilized in the emergency department (ED) for procedural sedation. It acts as an antagonist at the N-methyl-D-aspartate receptor. It has a long history of safety and efficacy in children and is increasingly being utilized in the adult population either alone or in combination with other sedative agents such as propofol [1-5]. Ketamine displays a favorable side effect profile when used for procedural sedation, lacking the cardiopulmonary depression seen with other agents [6,7]. Commonly observed adverse effects include transient increases of heart rate and blood pressure, emergence reactions, and purposeless movements [8-11]. Ketamine has rarely been implicated in the development of muscular hypertonicity and catalepsy, typically without consequence, but descriptions of this process are uncommon in the published medical literature [2,3,5,9,11]. We report a case of muscle rigidity associated with intravenous (IV) ketamine administration during procedural sedation that prohibited procedural completion but was mitigated by IV midazolam.

A 70-year-old woman with a past medical history significant for end stage renal disease, kidney transplantation, diabetes, hypothyroidism and osteoporosis presented to the emergency department with chief complaint of right ankle pain following a mechanical fall. Physical examination revealed a deformed right ankle with unremarkable neurologic and vascular examinations. Radiographs of the extremity revealed a trimalleolar ankle fracture with posterior tibiotaral dislocation. The patient received IV morphine for pain control. Orthopedic surgery was consulted for closed reduction in the emergency department with procedural sedation.

The patient weighed 83 kg and received 125 mg (1.5 mg/kg) dose of IV ketamine followed by intra-articular injection of the right ankle with 20 mL of 1% lidocaine. Adequate procedural sedation was achieved. Approximately two minutes following ketamine administration, bilateral lower extremity muscle rigidity was noted. Flexion at the hip joint was prevented locked rigidity to the knees and ankle joints bilaterally with increased lower extremity muscular tone. Passive flexion of the knee and passive extension of the ankle were prevented. This prohibited reduction of the right sided ankle fracture and dislocation. The patient’s respiratory status remained unchanged with no additional supplemental oxygen. Further examination did not reveal rigidity of the neck, chest, upper extremities, or abdomen. No incontinence, tongue biting, or seizure-like activity was noted. A 2 mg dose of IV midazolam was administered, with rapid improvement in the lower extremity muscular rigidity. The fracture and dislocation was then reduced and the lower extremity splinted. The patient was observed in ED and had an uneventful recovery without further complications.

Ketamine is a commonly used agent for procedural sedation in the ED. Several large case series have evaluated adverse events associated with ketamine use for procedural sedation in both children and adults [1-3,5,11]. Many of these have noted cases of either hypertonicity or clonus. The rates of hypertonicity have ranged from 1% to 16.3%. Severe events appear to be rare and typically of no consequence. Descriptions of these events or methods used to treat them are lacking in the published literature.

Studies conducted in rat and feline models have shown an association between ketamine and catalepsy, defined as an increased muscular tone without a response to external stimuli [12-15]. In feline models, ketamine-associated hypertonicity was avoided with premedication with xylazine, a central alpha2 receptor agonist [16]. In rat models, a dose-dependent catalepsy was noted. This response was augmented by the administration of morphine within the preceding 24 hours and was reversed by the administration of naloxone [14,17]. The mechanism for ketamine-induced catalepsy is unclear. Animal data is difficult to extrapolate to humans but the patient in our case did receive IV morphine for analgesia prior to procedural sedation with ketamine.

A previous case series documented two cases where ketamine administration was associated with muscle rigidity [9]. One case involved the use of ketamine for anxiety and bronchodilation following awake nasotracheal intubation in a patient with COPD. The other involved the use of procedural sedation with ketamine and propofol for shoulder dislocation reduction. These cases involved rigidity to the face and upper extremities. Both patients had uneventful recoveries without further pharmacologic intervention.

The patient in our case had muscle rigidity that involved the lower extremities with sparing of other muscle groups. Completion of the procedure was not possible secondary to this effect. Midazolam administration mitigated the rigidity, allowing completion of the procedure. It is possible that the ketamine effect was wearing off at the time of administration, but the fact that the muscle rigidity resolved so quickly after midazolam is interesting. A true cause and effect relationship is impossible to determine from this case.
With the increasing popularity of ketamine as an agent for procedural sedation, emergency providers need to be aware of possible side effects and how to manage them. Ketamine-associated muscle rigidity seems to be a rare phenomenon typically of little clinical consequence. Rarely, as in this case, ketamine-associated muscle rigidity can prohibit completion of certain procedures and may benefit from the administration of midazolam.

Albert Vien MD, MS*
Neeraj Chhabra MD

Department of Emergency Medicine, University of Illinois at Chicago
808 South Wood Street M/C 724, Chicago, IL 60612

Corresponding author. University of Illinois at Chicago, 808 South Wood Street M/C 724, Chicago, IL 60612
E-mail addresses: Albertcvien@gmail.com (A. Vien) neerajbc1@gmail.com (N. Chhabra)

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