Respiratory Arrest Following Intramuscular Ketamine Injection in a 4-Year-Old Child

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A healthy 4-year-old boy presented to the pediatric emergency department after inserting a black-eyed pea into his right external ear canal. Initial attempts at removal of this foreign body were unsuccessful, resulting in patient agitation. After administration of intramuscular ketamine for sedation, the patient was observed to experience one ineffective respiration followed by a period of apnea. No excessive oropharyngeal secretions or laryngospasm were noted. Spontaneous respirations resumed after 40 seconds, and the child recovered with no apparent ill effects. This case illustrates the need for adequate monitoring and preparation for emergency airway management when using ketamine for sedation in the ED.

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INTRODUCTION

Intramuscular ketamine has been used for pediatric sedation in the outpatient setting for many years. During this time, few complications have been reported in healthy children. Nevertheless, there has been controversy in the recent literature regarding appropriate use, monitoring, and preparation for resuscitation when ketamine is administered in the emergency department. We report a case of respiratory arrest without laryngospasm following the IM administration of ketamine in a healthy pediatric patient with no known contraindications; this complication has not been reported previously in the literature.

CASE REPORT

A 4-year-old boy presented to the pediatric ED after inserting a black-eyed pea into his right external ear canal. He complained only of a mild decrease in hearing on the affected side and was otherwise healthy.

Physical examination revealed a well-developed and well-nourished 4-year-old boy in no obvious distress. His

vital signs showed a blood pressure of 106/50 mm Hg; respirations, 26; pulse, 96; and temperature, 36.4 C. The patient's weight was 18 kg. Examination was normal except for a dried black-eyed pea visible deep in the right external ear canal.

Several attempts were made to remove the pea without success. The patient then became agitated. After we spoke with the patient's mother, it was decided to sedate the child with IM ketamine to facilitate removal of the foreign body. The patient was placed on cardiac and automated blood pressure monitoring devices as well as a pulse oximeter. A bag-valve-mask with intubation equipment was checked and made ready at the bedside. After discussing with the mother the possibility of adverse reactions, 72 mg ketamine (4 mg/kg) was administered intramuscularly into the right lateral thigh musculature. The syringe was aspirated before injection.

Within three minutes of administration the patient became unresponsive. This was followed by one shallow, ineffective respiration and then apnea. The patient was ventilated with 100% oxygen by bag-valve-mask for 40 seconds before he exhibited spontaneous but shallow respirations. No evidence of airway obstruction was noted during assisted ventilation. During this period of apnea the patient's blood pressure increased to 127/80 mm Hg and pulse increased to 140. The pulse oximeter demonstrated an oxygen saturation of 100% during assisted ventilation. There were no excessive oropharyngeal secretions. An arterial blood gas collected during the period of spontaneous, shallow respirations showed pH of 7.329; P_{CO_2}, 42.9; P_{O_2}, 97.7; and oxygen saturation, 96.5%. After a brief period, the patient's vital signs normalized.

The black-eyed pea was removed, and within two hours the patient was awake and alert and demonstrated no apparent adverse effects. Nevertheless, the admitting team was notified, and the patient was admitted to the pediatric ICU for overnight observation. He was discharged the next morning, still without evidence of adverse sequelae.

DISCUSSION

Ketamine hydrochloride is a dissociative anesthetic that has been used in clinical practice since the early 1970s. Its mechanism of action is unknown, although the sedative effect is thought to be exerted through a dissociation between the thalamoneocortical and limbic systems that prevents the higher brain centers from perceiving painful stimuli.[1-4] Numerous authors have reported it to be a safe and effective agent for pediatric sedation when painful or uncomfortable procedures must be performed.[5] Adverse effects associated with the use of this medication include excessive oral and tracheobroncheal secretions, muscular hypertonicity, transient clonus, transient stridor or laryngospasm, nemesis (both during sedation and well into the recovery period), transient rash, unpleasant agitation, nightmares, ataxia during recovery, mild respiratory depression, and apnea.[5,6]

Contraindications to ketamine sedation include its use in procedures involving stimulation of the posterior pharynx, a patient age of 3 months or less, the presence of active respiratory infection or disease, cardiovascular disease (including angina, heart failure, aneurysm, or uncontrolled hypertension), central nervous system pathology, glaucoma or acute globe injury, psychosis, thyroid disorder or medication, porphyria, and a history of airway instability, tracheal surgery, or tracheal stenosis.[6]

Advocates of its use state that ketamine is unique in its properties because protective airway reflexes are maintained without significant respiratory depression.[7-14] The paucity of reported complications combined with this theoretical ability to maintain an adequate airway implies that extensive monitoring may be unnecessary during use of this drug. A review article noted that clinical observation was the only monitoring technique reported by 14 of 97 authors.[5]

Kelly et al are not as enthusiastic regarding its use,[15] pointing out that the National Institutes of Health consensus conference on dental sedation classifies ketamine as a general anesthetic.[15] They argue that the common dose used for pediatric sedation, 4 mg/kg IM, should be classified as an anesthetic induction dose.[16] This classification necessitates the use of supplemental oxygen with adequate monitoring and preparation for emergent airway management whenever ketamine is used.

One of the most worrisome, although rare, respiratory complications is transient stridor and laryngospasm. A review of the literature noted that of 11,589 pediatric administrations of ketamine, only two cases of laryngospasm were severe enough to necessitate endotracheal intubation and that no cases of frank apnea were noted.[5] The complication of respiratory arrest also is rare and is seen primarily in the neonatal age group,[11,17-21] when ketamine is administered by rapid IV bolus,[1,10] and in patients with central nervous system pathology.[22-26] There also is a case report of a 15-month-old child with extensive pneumonia and a neck abscess who became apneic after IM injection.[18] A recent prospective study of 108 patients who received IM ketamine showed transient laryngospasm in only 0.9% of the cases with no evidence

of respiratory depression or respiratory arrest.[6] Our patient suffered respiratory arrest without upper airway obstruction and did not fit into any of the previously known high-risk categories.

SUMMARY

We report the case of a patient who suffered respiratory arrest following the IM administration of ketamine in a pediatric ED. The complication of apnea is rare and has been found only in specific circumstances such as rapid IV administration, use in the neonatal age group, and use in patients with central nervous system or respiratory pathology. Our patient did not fit into any of these categories.

This case highlights the present controversy regarding the use of IM ketamine or other forms of conscious sedation in the ED. If an ED were to momentarily become too busy to provide close monitoring for a patient or adequate preparations were not made, a case similar to ours might result in a tragic outcome. Despite their record of safety, whenever ketamine or other agents are used for conscious sedation, it is mandatory that ED staff use close observation, appropriate monitoring devices, and preparation for possible resuscitation.

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