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Seizures in a Child Sedated with Ketamine: A Rare Presentation

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Abstract
Pediatric procedural sedation outside the operating room is increasing in frequency and it's challenging. The main goals of pediatric sedation during radiologic imaging is to provide anxiety relief, pain control and control of excessive movement. Intravenous (IV) ketamine is commonly used for radiologic procedures. In our case report, a 9-year-old child developed generalized tonic-clonic seizures while undergoing Contrast-enhanced computed tomography (CECT) for torticollis after ketamine IV injection.
Keywords: *sedation; tonic-clonic seizure; ketamine; pediatric; intravenous.*

Introduction

Ketamine is pre-eminently suitable for sedation of pediatric patients undergoing procedures outside of the operating room. Ketamine differs from most other drugs used to induce anesthesia because of its significant analgesic effect, lack of depressant effect on the cardiovascular and respiratory systems. The S (+) isomer of ketamine is more potent and is associated with fewer side effects. Pediatric patients have fewer adverse emergence reactionsthan adults sedated with ketamine.[1] Ketamine has both pro-convulsant and anti-convulsant activity at various doses. We take the opportunity to mark this rare presentation and purported mechanisms involved with it.

Case report

A 9-year-old child, weighing 19 kg posted for Contrast-enhanced computed tomography (CECT) neck to rule out the involvement of spinal cord, as the C1 and C2 vertebra of the child were fused. This child has tilting of neck to the left side since birth. Birth, imminisation and developmental history were normal.The child had mild facial asymmetry (flattened left side of face) with prominent left sternocleidomastoid. The thoracic spine was lordotic. He was diagnosed to have Congenital sternocleidomastoid muscular torticollis with microcephaly.

As the child was very anxious, a long negotiation was needed to cannulate the child with a 20G IV(intravenous) cannula in the pre-recovery room. The child was taken to CT room, electrocardiography electrodes and pulse-oximeter probe were attached. Plain CT neck was done. Before giving contrast child became anxious and non-cooperative. Following which the child was administered 1mg/kg ketamine intravenously. The child developed generalized tonic-clonic seizures and became unresponsive to commands. The scene safety was ensured and 100% oxygen was administered through a face mask. Abnormal body movements persisted, following which 0.5mg midazolam was administered. The child began to improve and his abnormal movements subsided. Immediately arterial blood gas and random blood sugar analysis were done to rule out any electrolyte abnormalities and hypoglycemia, which were within normal range. He was then shifted to the post-recovery room.The child started responding after 10 minutes and there was no residual neurological deficit. Transthoracic echocardiography was done to rule out patent foramen ovale.

Discussion

The unique properties of ketamine that make it a fascinating option for procedural sedation, is its ability to cause sedation, amnesia, immobilization, profound analgesia and its least effect on respiratory function and hemodynamics. It is the only dissociative anesthetic available in the present era. Intravenous ketamine is used in many of the radiological procedures.Its effect on electroencephalogram (EEG) is questionable. Hence, various studies have been done to know its propensity to cause seizures. In our case report, a 9-year-old child, developed generalized tonic-clonic seizures after administering intravenous ketamine for procedural sedation. Through this case report, we find an opportunity to discuss this rare effect of ketamine.

Proposed Mechanisms of action of Ketamine for its Pro-Convulsant Activity

The pro-convulsant activity of ketamine can be attributed to various nutritional, environmental factors, phenotypical and genotypical variation in the patient population and drug interactions.[2] The variation in the mechanism of action of ketamine at different centers could explain the pro-convulsant effect as stated in various human and animal studies. The depressant action of the drug on the neocortical- thalamic axis was clearly established in cats, which was strengthened by experiments of Massopust and co-workers in primates.[3,4] Corssen et al proposed that ketamine selectively activated the hippocampus producing θ waves along with the onset of corticothalamic depression producing hypersynchronous δ waves in cat brain. This was recorded at low doses of ketamine (< 4mg/kg intravenously) during sedation or awakening. This activation of the limbic system was proposed as one of the mechanisms for its pro-convulsant effect.[5] Ferrar-Allado T et al experimented on epileptic patients and stated that,ketamine activates the hippocampus which subsequently spread to thalamic regions, and over-rides its depression on these areas. This may be one of the possible reasons to cause seizures.[6]

Ketamine may have a pro-convulsant effect at low doses.[7] The phenotypical susceptibility to seizures after the administration of ketamine was observed when 5 out of 22 cats with black/brown stripes developed ketamine-induced seizures.[8] Jitesh et al have reported generalized tonic-clonic seizures in a 10-year-old boy 5 min after intramuscular ketamine.[9] Madhuri et al also reported tonic-clonic seizures in an 8-year-old child undergoing tongue tie release surgery after IM ketamine administration.[10]Ketamine induces rhythmic muscle contractions involving the upper and/or lower extremities which are of extrapyramidal in origin without EEG changes. They may occur during induction and last for 30 seconds to several minutes. This should not be

confused with myoclonic seizures which have EEG activity.

This child had generalized tonic-clonic seizures with frothy secretions which responded well to IV midazolam. Premedication with benzodiazepines may be useful. Ketamine needs to be used cautiously when used in low doses.

Conclusion

Low dose ketamine should be used cautiously for procedural sedation and premedication with benzodiazepines may prevent this untoward complication of ketamine.

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