

An Unique Method to Paediatric Procedural Anaesthesia: Integrating IM Precedex and Ketamine

Haynice Eeiva, Guis Yarcia

Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto, USP, HCFMRP-USP, Brazil

***Corresponding Author :** Haynice Eeiva, Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto, USP, HCFMRP-USP, Brazil

Received : July 09, 2023 ; **Accepted:** July 10, 2023 ;

Published : August 10, 2023

ABSTRACT

Research indicates that the combination of dextroketa mine and dexmedetomidine enables children to be safely and effectively sedated throughout various anaesthetic operations. In this association, known as Ketodex in the literature, ketamine not only counteracts the sympatholytic effects of dexmedetomidine but also lessens the negative effects of ketamine in the central nervous system, including sialorrhea, with the added benefit of not causing respiratory depression or bronchial hyperreactivity. We describe a difficult case with a youngster who had many punctures that rendered vascular access impractical, leading to thrombosis of the venous bed. The injectable Ketodex option proved to be a safe, painless, and effective sedation alternative in this circumstance.

Keywords : *Children; Intramuscularly; Ketodex; Procedural sedation*

INTRODUCTION

Both surgical and noninvasive treatments are still often used and essential in the care of kids with both acute and chronic illnesses. Procedure-related problems are more likely to occur in individuals with underlying co-morbid illnesses, even if procedural sedation is usually safe and effective. In order to lessen the incidence of sevoflurane agitation and with the benefit of

not producing respiratory depression, ketamine, an NMDA receptor antagonist, has been utilised extensively as an alternative to the use of inhalational drugs for sedation, analgesia, and amnesia. At clinical dosages, the highly selective alpha-2 agonist dexmedetomidine also exerts sedative, analgesic, and anxiolytic effects without causing appreciable respiratory depression. Ketamine and dexmedetomidine have been shown to be safe and efficient in achieving successful sedation, even when used by non-anesthesiologists.

The intramuscular route is recommended for patients who are uncooperative or unable to take oral medications because it offers a rapid systemic action, with nearly 80% bioavailability and a plasma concentration peak in approximately 15 minutes. Subsequently, the intramuscular delivery of both Ketamine and Dexmedetomidine may present a compelling alternative for procedural sedation in kids, who are typically uncooperative, agitated, or have trouble gaining venous access. In order to provide parenteral antibiotic therapy for a thirteen-year-old child with acute ventriculitis, we report the use of an intramuscular combination of ketamine and dexmedetomidine for procedural sedation.

Case Report

A 13-year-old child with post-natal neuropathy, weighing 36 kg, was admitted to the Emergency Unit with a fever (39°C) and headache after eight hours of fasting. After a lumbar puncture and cranial tomography, the child's condition was determined to be ventriculitis. Antibiotic therapy had to start right away. He arrived nervously in the radio intervention room without a tracheostomy, gastrostomy, or venous access, and he had a history of multiple peripheral and deep vein thromboses (thrombosis of the jugular, subclavian, and femoral veins). To perform suprahepatic central venous access under the guidance of radiography and ultrasound, anaesthesia was required. Therefore, a combination of dextroketa mine and dexmedetomidine was decided to be injected intramuscularly. A 30G 13x4.5 mm nee-

Case Report

dle was used to administer 3 ml of 1% lidocaine as a previous local anaesthetic to the vastus medialis muscle and a dilution was made in a 5-milliliter syringe with a concentration of 20 mg/ml dextrose and 10 mcg/ml dexmedetomidine. We decide to use a 22G needle and a dose of 1 mcg/kg of dexmedetomidine in combination with 2 mg/kg of dextroketa mine (3.6 ml solution). The child achieved state 2 on the Paediatric Sedation State Scale (PSSS) [5] in less than five minutes (Figure 1). The radiology technician injected lidocaine into the child, but the child did not react and stayed motionless for the entire 35-minute procedure. Peripheral oxygen saturation was 98%, eupneic, hemodynamically stable, heart rate was 80–90 beats per minute, and non-invasive arterial pressure was between 100–110 mmHg. It was not required to use extra oxygen (Figures 1 and 2). The young person was recommended to the post-anesthetic room, where they were released after 20 minutes of spontaneous breathing.

Discussion

The Food and Drug Administration (FDA) in the United States first approved dexmedetomidine, an alpha-2-adrenergic agonist, in 1999 for the sedation of adults undergoing mechanical ventilation. In 2009, the FDA again approved the medication for adult Monitored Anaesthesia Care (MAC). It has been successfully used in a number of clinical scenarios, including sedation during mechanical ventilation, procedural sedation, postoperative analgesia, prevention of emergence delirium, post-anesthesia shivering control, and the treatment of withdrawal from various substances, including opioids and benzodiazepines, despite not having a specific FDA-approved indication for use in infants and children.

Concerns regarding the anaesthetic management of our patients included the requirement for an effective sedation to carry out a potentially painful procedure without compromising hemodynamic or ventilatory function. In addition to the analgesia that dexmedetomidine does not provide, ketamine therapy increases heart rate (HR) and blood pressure (BP) to counteract dexmedetomidine's bradycardia and has a quicker onset than dexmedetomidine alone. Many of the potentially harmful effects of ketamine are avoided by dexmedetomidine, such as emergence agitation, excessive salivation, and stimulation of the cardiovascular system (increased heart rate and blood pressure) [6]. As the combination of dexmedetomidine and ketamine continues to show promise in prospective tri-

als, case series, and isolated case reports, clinical experience with this combination is growing. But even though dexmedetomidine works well when used alone to sedate patients during non-painful radiologic imaging, it might not work as well when used alone to sedate patients during painful procedures.

A single intramuscular dosage of dexmedetomidine and ketamine was sufficient to induce a good level of sedation in our patient. A retrospective review of this combination for cardiac catheterization sedation in paediatric patients with heart disease was conducted by Mester et al. After three minutes of an intravenous bolus injection of ketamine (2 mg/kg) and dexmedetomidine (1 mg/kg), dexmedetomidine was continuously infused. The insertion of the venous and arterial cannulas and their infiltration into the groyne caused no patient to react. After repositioning their airways, two patients who had upper airway obstructions recovered. The highest PaCO₂ reading was 48 mmHg, and there was no evidence of central apnea. Dexmedetomidine and ketamine were successfully used by McVey and Tobias to provide procedural sedation for lumbar punctures used to create spinal anaesthesia in 12 paediatric patients. The ketamine and dexmedetomidine dosage schedule matched the information provided by Mester et al. Additional research has demonstrated that even at low doses, the combination of ketamine and dexmedetomidine provides children with safe and efficient sedation during a variety of surgical procedures.

For procedures requiring a deep level of sedation while preserving spontaneous breathing, Joseph Tobias has repeatedly shown the value of using dexmedetomidine in addition to ketamine [16]. Patients with severe co-morbid conditions, such as congenital heart disease, sleep apnea, pulmonary hypertension, tracheal compression from a mediastinal mass, and impaired cardiac and respiratory function, have been included in a number of reports. These studies show that a combination of dexmedetomidine and ketamine efficiently produces the required degree of sedation with the lowest possible risk of side effects. Tobias also came to the conclusion that the best course of action for procedural sedation appears to be the intravenous bolus injection of both ketamine (1-2 mg/kg) and dexmedetomidine (1 µg/kg) to start the sedation process. In this case, the two agents can be given from a single syringe in tandem [16]. Ketamine's distinct qualities and adaptability have made it more and more well-liked in prehospital and emergency medicine worldwide. It has been reported that intramuscular, oral,

Case Report

or intranasal ketamine administration has been effective when intravenous access is challenging. Additionally, dexmedetomidine can be administered intravenously or intramuscularly. For premedication, a dose of 0, 33-0, 67 mcg/kg IV or 2, 5 mcg/kg IM should be administered via injection 15 minutes prior to the procedure. Therefore, it would be normal for the intramuscular combination of both medications to be used. To the best of our knowledge, there are no published reports on the intramuscular administration of dexmedetomidine and dextroketa mine in humans. A study that links the two medications intramuscularly in swine has been published, demonstrating the combination's safety and effective sedation. In this case study, it was found that administering the drugs intramuscularly in a bolus at the recommended doses and combining them in one syringe proved to be a very painless, safe, and effective way to accomplish a procedure without agitation. It also ensured hypnosis and analgesia, prevented hypoventilation or any alteration in respiratory pattern, and served as a great substitute for sedation in children with co-morbidities. In the practise of anaesthesia, ketodex is a very versatile mixture. Finding a position in a growing number of medical operations. We proved that administering the combination intramuscularly with a single syringe is a workable substitute for sedation during paediatric surgery.

Conclusion

A thirteen-year-old boy with acute ventriculitis was effectively sedated for transhepatic central venous access with a single intramuscular dosage of dexketamine and dexmedetomidine. Because there is no venous access and spontaneous ventilation must be maintained without agitation from sevoflurane or pollution from the environment, this combination of agents was selected. The use of any anaesthetic agent during a procedure carries the risk of both hemodynamic and respiratory depression. In light of these worries, procedural sedation requires adequate monitoring, access to resuscitation drugs, and airway equipment. Keeping these warnings in mind, we think that, as demonstrated in the case study, the combination of dextroketa mine and dexmedetomidine (Ketodex) administered intramuscularly could be a viable option for procedural sedation in paediatric patients, even those with co-morbid conditions. In different medical situations. Valid information regarding safety, time of awakening, and cost effectiveness may be obtained from future clinical trials comparing various sedation regimens with other sedatives and routes of administration.

References

1. Malviya S, Voepel-Lewis T, Eldevik OP, Rockwell DT, Wong JH, et al. (2000) Sedation and general anaesthesia in children undergoing MRI and CT: adverse events and outcomes. *Br J Anaesth* 84: 743-748.
2. Abu-Shahwan I, Chowdary K (2007) Ketamine is effective in decreasing the incidence of emergence agitation in children undergoing dental repair under sevoflurane general anesthesia. *Paediatr Anaesth* 17: 846-850.
3. Kamibayashi T, Maze M (2000) Clinical uses of alpha2-adrenergic ago-nists. *Anesthesiology* 93: 1345-1349.
4. Corcuera-Flores JR, Silvestre-Rangil J, Cutando-Soriano A, López-Jiménez J (2016) Current methods of sedation in dental patients - a system-atic review of the literature. *Med Oral Patol Oral Cir Bucal* 21: 579-586.
5. Cravero JP, Askins N, Sriswasdi P, Tsze DS, Zurakowski D, et al. (2017) Validation of the Pediatric Sedation State Scale. *Pediatric* 139: 20162897.
6. Tobias JD (2007) Dexmedetomidine: applications in pediatric critical care and pediatric anesthesiology. *Pediatr Crit Care Med* 8: 115-131.
7. Levanen J, Makela ML, Scheinin H (1995) Dexmedetomidine premedica-tion attenuates ketamine-induced cardiostimulatory effects and postanesthet ic delirium. *Anesthesiology* 82: 1117-1125.
8. Mester R, Easley RB, Brady KM, Chilson K, Tobias JD (2008) Monitored anesthesia care with a combination of ketamine and dexmedetomidine during cardiac catheterization. *Am J Ther* 15: 24-30.
9. McVey JD, Tobias JD (2010) Dexmedetomidine and ketamine for sedation during spinal anesthesia in children. *J Clin Anesth* 22: 538-545.
10. Bozdogan N, Sener M, Caliskan E, Kocum A, Aribogan A (2008) A combination of ketamine and dexmedetomidine sedation with caudal anesthesia during incarcerated

Case Report

- inguinal hernia repair in three high-risk infants. *Pediatr Anesth* 18: 1009-1011.
11. Barton KP, Munoz R, Morell VO, Chrysostomou C (2008) Dexmedetomidine as the primary sedative during invasive procedures in infants and toddlers with congenital heart disease. *Pediatr Crit Care Med* 9: 612-615.
 12. Luscri N, Tobias JD (2006) Monitored anesthesia care with a combination of ketamine and dexmedetomidine during magnetic resonance imaging in three children with trisomy 21 and obstructive sleep apnea. *Pediatr Anesth* 16: 782-786.
 13. Mason KP, Zurakowski D, Zgleszewski SE, Robson CD, Carrier M, et al. (2008) High dose dexmedetomidine as the sole sedative for pediatric MRI. *Paediatr Anaesth* 18: 403-411.
 14. Tobias JD, Berkenbosch JW (2002) Initial experience with dexmedetomidine in paediatric-aged patients. *Paediatr Anaesth* 12: 171-175.
 15. Jalowiecki P, Rudner R, Gonciarz M, Kawecki P, Petelenz M, et al. (2005) Sole use of dexmedetomidine has limited utility for conscious sedation during outpatient colonoscopy. *Anesthesiology* 103: 269-273.
 16. Goyal R, Singh S, Shukla RN, Patra AK, Bhargava DV (2013) Ketodex a combination of dexmedetomidine and ketamine for upper gastrointestinal endoscopy in children: a preliminary report. *J Anesth* 27: 461-463.
 17. Tobias JD (2012) Dexmedetomidine and ketamine: an effective alternative for procedural sedation. *Pediatr Crit Care Med* 13: 423-427.
 18. Gales A, Maxwell S (2018) Ketamine: Recent Evidence and Current Uses. *ATOTW* 381: 1-7.
 19. Naaz S, Ozair E (2014) Dexmedetomidine in Current Anaesthesia Practice-A review. *J Clin Diagn Res* 8: 01-04.
 20. Santos M, Bertrán de Lis BT, Tendillo FJ (2016) Effects of intramuscular dexmedetomidine in combination with ketamine or alfaxalone in swine. *Vet Anaesth Analg* 43: 81-85.