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Review Article

Clinical use of Dexmedetomidine for Sedation

Ayşe Ülgey*, Aynur Mustafayeva, and Buket Kapçak

Department of Anesthesiology and Critical Care, University of Erciyes, Turkey

***Corresponding author**

Ayşe Ülgey, Department of Anesthesiology, Erciyes University Medical Faculty, 38039 Kayseri, Turkey, Email: aulgey@erciyes.edu.tr

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Abstract

Current increase of invasive and noninvasive clinical procedures creates great demand for sedation. This sedation may also provide analgesia, anxiolysis, and hypnosis. Protection of respiratory and cardiovascular system is very crucial in anesthesia and intensive care procedures. Thus appropriately given sedation may reduce the duration of surgical procedures, create excellent pain management, improve the quality of technique and increase patient comfort. Moreover, selection, dosing, combination and administration of proper anesthetic medications are important for appropriate sedation and anesthesia.

Current papers show that Dexmedetomidine is widely and safely used anesthetic medication in pediatric and adult population. It may be administered for sedation, analgesia, general and regional anesthesia alone or with another drug combination. Dexmedetomidine provides sedation with no respiratory depression that makes an advantage in clinical use. Dexmedetomidine is also introduced as an organ protective anesthetic medication.

High bioavailability of sublingual dexmedetomidine which is about 84% increases the importance of it in pediatric sedation settings. Excretion ways are mostly urine (95%) and feces (4%).

Emergency medicine, surgery, cardiology (PCC), radiology (MRI and CT-scan, EEG), Intensive Care unit are the fields where dexmedetomidine extensively used.

ABBREVIATION

MRI: Magnetic Resonance Imaging; ICU: Intensive Care Unit; CT: Computed Tomography; PCC: Pediatric Cardiac Catheterization

INTRODUCTION

Dexmedetomidine as a reliable sedative drug is vastly used for short-term ICU sedation purpose. It was reported that a redistribution half-life of dexmedetomidine in children is about nine min, whereas an elimination half-life is about 110 min [1].

Dexmedetomidine is selective α2 adrenoceptor agonist medication that has sedative, sympatholytic, amnestic, and analgesic effects [2,3], that has been placed in a number of clinical trials as useful and safe substance. Providing an excellent analgesia, conscious sedation where patients seem to be asleep, however can easily be awaken, in addition no respiratory depression, make dexmedetomidine one of the widely used medication in anesthesia. Dexmedetomidine may decrease sympathetic nervous system regarding the used dose. It also has organ protective effects like cardio protection, neuroprotection and renoprotection [4], against injuries that may occur in ischemia and hypoxia.

Use of dexmedetomidine was described in various studies on patients who underwent pediatric cardiac catheterization procedure [5-8]. Providing deep sedation is very crucial for in pediatric cardiac catheterization laboratories. For children undergoing cardiac catheterization while giving sedation, it is important to secure respiratory system like keeping airway open and maintain hemodynamic stability of cardiovascular system [5-7,9].

Munro et al. [6], carried out a study about dexmedetomidine use in 20 children aged 3 months and 10 years undergoing cardiac catheterization. Eight out of twenty patients have been sedated only with dexmedetomidine, 12 patients needed additional sedation with propofol. Dexmedetomidine was given in 1mcg/kg as a loading dose in ten mins. The study revealed no airway obstruction or hemodynamic instability. They found that dexmedetomidine may be used either alone or with a combination of another sedative anesthetic in spontaneously breathing patients who undergo cardiac catheterization.

Another study done by Ülgey et al. [8], where 60 children undergoing cardiac catheterization were divided into two groups the first one is ketamine-propofol and the second one is ketamine-propofol-dexmedetomidine group. As a sedative dose ketamine was given in 1 mg/kg, propofol was given 1 mg/kg, and dexmedetomidine was added in 1mcgr/kg in five min infusion. The study revealed that decreased consumption of propofol

with addition of dexmedetomidine prevented cardio respiratory depression, lowered airway complications and reduced the time recovery time of patients.

Mester et al. [5], in Retrospective cohort study showed that 16 patients who underwent PCC under sedation with dexmedetomidine (1 mcg/kg) and ketamine (2 mg/kg) for induction, may provide effective sedation and less changes in respiratory and cardiovascular function.

In randomized study by Tosun et al. [7], 44 patients who underwent pediatric cardiac catheterization (PCC) were divided into Ketamine-propofol (KP) and Ketamine-dexmedetomidine (KD) groups. The study showed that heart rate was obviously lower in KD group than in KP group; however recovery time duration was longer in KD group than in KP group (49 and 23 mins respectively).

Dexmedetomidine use for a fiber optic intubation [10,11] was also described in several studies. Bergese et al. [11], in their experience with 4 various cases used dexmedetomidine for fiber optic intubation purpose on conscious patients, and showed that using Dexmedetomidine for sedation did not change saturation values, and did not have any depressive effect on respiratory system. Dexmedetomidine dose for conscious intubation was selected about 0.5 mcg/kg/hr.

In another randomized study by Bergese et al. [10], 55 patients who needed fiberoptic intubation were divided into midazolam-dexmedetomidine and only midazolam groups. The level of patient satisfaction and tolerance in midazolam-dexmedetomidine group was higher than in only midazolam group.

Chu et al. [12], in the study included 30 oral cancer patients with restricted mouth opening circumstance required fiber optic intubation were selected in fentanyl and dexmedetomidine groups. Each medication was given in 1 mcg/kg dose. Dexmedetomidine group patients showed high tolerance to procedure and less changes in cardio respiratory system.

Sinha et al. [13], in a study where 60 patients with age of 18-60 years were selected for elective surgery under general anesthesia for fiber optic intubation purpose. Patients were placed in two groups: dexmedetomidine-ketamine and only dexmedetomidine group. Results showed that first group was more hemodynamically stable and sedative than the second one.

Lui et al. [14], in a prospective study enrolled 115 children below three years of age were selected for transthoracic echocardiography. All children were sedated with intranasal dexmedetomidine. The results showed that additional oxygen was required only in one child, however all the other children experienced sufficient comfort and proper sedation with normal hemodynamic signs.

Koroglu et al. [15], in a study where 60 pediatric patients undergoing MRI were divided into dexmedetomidine (initial dose 1mcg/kg) and propofol (initial dose 3 mg/kg) groups. The study reported that in spite of adequately achieved sedation in most patients of both groups, children were prone to desaturation and hypotension in propofol group.

In another study done by Koroglu et al. [16], 80 children aged 1 and 7 were selected for MRI study to be sedated with either dexmedetomidine or midazolam. Regarding the quality of MRI and level of sedation dexmedetomidine group experienced higher results than midazolam group. Dexmedetomidine group showed more cardiovascular and respiratory stability than midazolam group.

Miller et al. [17], reported that intranasal dexmedetomidine provided effective sedation in 62 patients out of 63(98%) with various types of congenital heart defects who were selected for TTE (transthoracic echocardiography) with the age of three months to three years. The optimal optimal dose of dexmedetomidine in this setting was 2.5-3.0 mcg/kg [17].

Discussion and Conclusion: Dexmedetomidine is chemically active dextroisomer of the imidazole compound, medetomidine. Its pharmacology and mechanism of action have been extensively reviewed elsewhere [18,19]. Administration of dexmedetomidine with negative chronotropic drugs such as digoxin, may result with cardiac arrest as it directly effects conduction system on sinus and atrioventricular node level [20-23].

Dexmedetomidine is a valuable adjunct for adult procedural sedation [24,25] as well as pediatric patients. Several reports were reported of its safe and effective use in the pediatric ICU [26,27]. Kristin et al. [28], reported that invasive procedures may be performed in spontaneously breathing children with different congenital heart defects using dexmedetomidine 1-3 mcg/kg alone or with a combination of low dose ketamine.

Walker et al. [29], administered dexmedetomidine on 65 patients with burn injuries and whose sedation was not adequate with opioids or benzodiazepines. Dexmedetomidine was started at with the dose of 0.2 mcg/ kg/hr infusion in all patients. 26 of patients received as loading dose of dexmedotomidine in 1 mcg/ kg. The average duration of Dexmedetomidine infusion was 11 days. As dexmedetomidine infusion started, all patients were observed being adequately sedated. When sedation was not required furthermore, infusions were weaned within 12 to 24 hours. 42 of the 65 patients (65%) were mechanically ventilated when Dexmedetomidine infusion started. Mechanical ventilation was accomplished in 11 out of 42 patients on Dexmedetomidine infusion, while respiratory depression was not observed in this circumstance.

Canpolat et al. [30], in a study including 60 burn patients at the age of 8-60months old with second degree of burns underwent dressings were placed in two groups who received ketamine-propofol (KP group) and ketamine-dexmedetomidine (KD group). The study revealed that sedation level, saturation range and diastolic arterial pressure were almost similar in both groups, however, systolic arterial pressure was higher, and recovery time was longer in KD group, whereas respiratory depression was higher in KP group.

In conclusion, sedative, analgesic, anxiolytic, opioid–sparing, organ-protective and respiratory securing properties make dexmedetomidine an excellent medication of choice for a doctor in anesthesia and critical care circumstances. Side effects like bradycardia and hypotension, as well as high cost may create restrictions in clinical use of dexmedetomidine.

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