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Role of a subanesthetic dose of ketamine for perioperative analgesia in a patient of cerebral palsy posted for spasticity corrections of lower limbs: A case report

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ABSTRACT

Spastic type of cerebral palsy is the commonest disorder is associated with childhood disability. For spasticity corrections, orthopedic procedures are performed which are extremely painful. So, adequate pain relief is the priority during the immediate postoperative period for good perioperative outcomes. Ketamine being an N-Methyl D aspartate (NMDA) receptor antagonist blunts central pain sensation at a subanesthetic dose (0.3mg/kg or less IV) and is used as an adjuvant for perioperative analgesia. A subanesthetic dose has a minimal physiological impact as compared to an anesthetic dose. Ketamine, as a subanesthetic dose improves pain score and decreases opioid consumption during the perioperative period. We present, a case of a twelve-year-old female child known case of cerebral palsy came for spasticity correction of lower limbs under general anesthesia.

Keywords: Spastic diplegia, N-Methyl D aspartate (NMDA), perioperative analgesia

1. INTRODUCTION

As a result of an injury to the developing brain during the perinatal period there is a chance of the development of a heterogenous non progressive disorder known as cerebral palsy. Spastic diplegia is the commonest type that is associated with cerebral palsy (Mishra et al., 2022). For spasticity corrections, orthopedic procedures are performed which are extremely painful. Therefore, to achieve good perioperative outcomes, adequate pain relief in the immediate postoperative period is needed. Ketamine being an N-Methyl D aspartate (NMDA) receptor antagonist at an anesthetic dose (>1mg/kg IV) causes a dissociative anesthetic state because of its effects on the central nervous system (Domino, 2010). From the 1980s, studies revealed the role of NMDA receptors in pain processing. Therefore, ketamine has received

interest as an analgesic (Chizh, 2007). The role of a subanesthetic dose of ketamine as an analgesic for acute pain in a perioperative setting has been studied extensively (Himmelseher and Durieux, 2005).

2. CASE HISTORY

A twelve-year-old female child, known case of cerebral palsy with spastic diplegia with right side adductor contracture with bilateral patella came for surgical correction in the orthopedic department of our tertiary care hospital (Figures 1, 2).

Figure 1 A and B) Spastic deformities of lower limbs in children with cerebral palsy

As a previous history of patient narrated by his father, the patient had deformities of both lower limbs from birth which were insidious in onset and gradually progressive. The patient was bedridden since childhood. Motor milestones were delayed as per age. Cognitive and communication skills were normal. Bilateral hamstring lengthening with bilateral patella imbrication with right adductor tenotomy was planned for the patient. Figure 2 was showing intraoperative surgical correction.

Figure 2 Surgical correction of spastic diplegia

A thorough pre-anesthetic checkup was done to ensure uneventful perioperative period. The physical examination revealed a weight of 20kgs. The chest was clear on auscultation and no abnormal heart sounds were heard. Investigations were normal. No history recurrent chest infection and seizures.

A written, informed consent was taken and general anesthesia was planned. IV line was secured and ringer lactate started. Monitors like pulse oximeter, noninvasive BP (NIBP) and electrocardiogram (ECG) were attached and baseline pre-induction vitals were noted. General anesthesia was planned for this cerebral palsy patient in view of securing airway. Pre medications with inj. Pantoprazole 20mg IV were given. Inj. glycopyrrolate 0.08mg IV (0.004mg/kg) was given to avoid secretions. The patient was induced with inj. propofol 40mg IV (2mg/kg) and inj. fentanyl 20mcgs IV (1mcg/kg). Inj. Ketamine 6 mg IV bolus (0.3mg/kg) as a subanesthetic dose was given along with induction agents. After confirmation of ventilation, rapid sequence intubation was done by using succinylcholine and intubation was done with a 5.5 mm cuffed endotracheal tube. Urinary catheterization was done for urine output monitoring. Hypothermia was avoided by using warming IV fluid and a warming blanket with forced air warmer. Depth of anesthesia was maintained on sevoflurane 1% or less and atracurium muscle relaxant top-ups. Intraoperatively, ketamine as a subanesthetic dose (0.1-0.3mg/kg IV) was given every one hourly for maintaining analgesia. There were no changes in hemodynamics after giving a subanesthetic dose of ketamine. The last top-up dose of ketamine was avoided 30 mins prior to emergence. IV fluids were given according to maintenance and losses.

After completion of the surgery, spontaneous ventilation was confirmed and reversal of neuromuscular blockade with inj. myopyrrolate 1mg IV (0.05mg/kg) was started. Extubation was done after confirming adequate ventilation and complete awakening of the patient. Immediately after extubation, the patient was pain-free and shifted to post-op recovery room for observation. No incidence of post operative nausea and vomiting was noted due to the decrease requirement of opioids post operatively.

3. DISCUSSION

As a result of an injury to the developing brain during the antenatal, perinatal or postnatal period there is chance for development of cerebral palsy. Patients with CP are posted electively for surgical correction of deformities. The main anaesthetic concerns of anaesthesia are intraoperative hypothermia and slow emergence from anaesthesia. A rapid sequence induction may be indicated with succinylcholine because it does not cause hyperkalemia in patients with cerebral palsy. The temperature should be monitored and a patient should be kept warm. Because of cerebral abnormalities, the patient should remain intubated until fully awake and airway reflexes have returned. Postoperative pain management is important. Epidural analgesia can be performed for post-operative analgesia (Rudra et al., 2008).

Though ketamine is known to cause psychomimetic effects in the form of hallucination, out of body sensation, vivid dreams, dysphoria at an anesthetic dose (1mg/kg or more) but a subanesthetic dose of ketamine has a lower risk for psychomimetic effects (Laskowski et al., 2011; Elia and Tramèr, 2005). A two-large systemic review of subanesthetic doses of ketamine reported a lower incidence of psychomimetic effects. At subanesthetic dose consciousness and arousal are not significantly affected (Gorlin et al., 2016). In our case, immediately after the emergence of general anesthesia, there was no incidence of psychomimetic effects.

Ketamine at higher doses causes an increase in oral secretions and the incidence of laryngospasm (Craven, 2007). But subanesthetic dose does not have any significant effect on the respiratory system. The concern related to respiratory system for the cerebral palsy patient is aspiration due to weak pharyngeal tone but according to various studies, subanesthetic dose does not increase secretions as compared to the anesthetic dose.

A systemic review shows that lower doses of perioperative ketamine have no risk of nausea and vomiting (Stubhaug et al., 1997). Cochran review of the perioperative subanesthetic dose of ketamine was suggestive that due to the opioid-sparing effects, a significant reduction in nausea and vomiting was observed with ketamine (Bell et al., 2006).

In our case, we have used a subanesthetic dose of ketamine (0.3mg/kg or less IV) and observed that a low dose of ketamine provides intraoperative analgesia without any change in hemodynamics. A subanesthetic dose also provides acute pain relief immediately after surgery and that leads to a decrease requirement of opioids during the postoperative period. Ultimately, it improves the perioperative outcome after surgical correction.

4. CONCLUSION

In patients of cerebral palsy with spastic diplegia posted for spasticity corrections, surgical procedures are extremely painful. So, for achieving good perioperative outcomes, adequate pain relief in the immediate postoperative period is become priority. Ketamine being as an NMDA receptor antagonist blunts central pain sensation at a subanesthetic dose (0.3mg/kg or less IV). The subanesthetic dose of ketamine studied extensively for analgesia in a perioperative setting. Ketamine, at a subanesthetic dose, improves pain scores postoperatively and decreases overall perioperative opioid consumption.

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Author Contributions
Dr Maitri Patel: Selection of case and manuscript preparation
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Dr Kashyap Kanani: Selection of figures

Informed consent
Written & Oral informed consent was obtained from participant included in the study.

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Conflict of interest
The authors declare that there is no conflict of interests.

Data and materials availability
All data sets collected during this study are available upon reasonable request from the corresponding author.

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