ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 06 | June - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

ANAESTHETIC CONSIDERATIONS IN A CHILD WITH SPASTIC DIPLEGIC CEREBRAL PALSY POSTED FOR SURGERY

Anaesthesiology

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ABSTRACT

Cerebral palsy is a non-progressive neurological disorder associated with significant anaesthetic challenges due to spasticity, developmental delay, airway concerns, altered drug responses, and thermoregulatory disturbances. We report the anaesthetic management of a 6-year-old female child with spastic diplegic cerebral palsy posted for botulinum toxin injection with casting for lower limb spasticity. General anaesthesia was administered using intravenous agents with avoidance of inhalational anaesthetics because of concerns regarding delayed emergence, hypothermia, and possible susceptibility to malignant hyperthermia. Anaesthesia was induced with propofol and maintained using propofol target-controlled infusion with stable intraoperative haemodynamics and temperature maintenance. The perioperative course remained uneventful, and recovery was smooth without complications. This case highlights the importance of individualized anaesthetic planning in children with cerebral palsy and demonstrates that propofol-based total intravenous anaesthesia can provide safe and effective perioperative management while minimizing complications associated with volatile anaesthetic agents.

KEYWORDS

Cerebral Palsy; Spastic Diplegia; Paediatric Anaesthesia; Propofol Infusion; Target-Controlled Infusion; General Anaesthesia; Malignant Hyperthermia; Botulinum Toxin Injection; Hypothermia; Total Intravenous Anaesthesia (TIVA).

INTRODUCTION

Cerebral Palsy(CP) is a group of permanent neurological disorders affecting the development of movement and posture, causing activity limitation. It is attributed to non-progressive disturbances that occur in the developing fetal/infant brain, the chief causes being cerebral malformations, perinatal hypoxia and TORCH infections. Incidence of CP is approximately 1.5–3 per 1000 live births. Based on the predominant motor affection, CP is classified into four types, namely spastic(most common, 70%), dyskinetic, ataxic and mixed. Spastic diplegia is a common form of spastic cerebral palsy, resulting in lower limb spasticity and gait disturbances. Clinical features of CP include global developmental delay, increased tone and involuntary movements. These children often develop contractures and joint deformities which require therapeutic interventions such as botulinum toxin injection and serial casting to improve functional outcomes. Other commonly performed procedures in these patients include tenotomies/osteotomies, soft tissue release, correction of spinal deformities such as scoliosis, dental extractions, gastrostomy and anti-reflux procedures.[1,4]

Anaesthetic management in cerebral palsy is complex because of associated neurological impairment, developmental delay, airway difficulties, gastro-esophageal reflux, altered drug responses and thermoregulatory abnormalities.[2] [3] Inhalational anaesthetics are known to be associated with delayed emergence and risk of hypothermia. There are also a few isolated reports of hypermetabolic reactions and associated neuromuscular abnormalities, linking it to the risk of malignant hyperthermia. These warrant consideration regarding the choice of anaesthetic agents, particularly inhalational agents, due to their possible role as triggers for malignant hyperthermia.[2]

Case Report

A 6-year old female child weighing 15 kg, known case of spastic diplegic cerebral palsy, was posted for botulinum toxin injection with casting in the lower limbs for management of lower limb spasticity. The patient had presented to the Orthopaedic department with h/o difficulty in walking since 2.5 years of age. She had signs of developmental delay and was on regular oral Baclofen therapy since the last one year. There was delay in presentation to a tertiary setup due to lack of medical facilities near her village. Birth history revealed delivery by LSCS in view of fetal distress and cry was delayed by 5 minutes. On preoperative examination, the child was conscious and oriented, but had mild intellectual disability. She was able to walk only with support.Vital parameters were stable. Airway examination revealed adequate mouth opening, no pain or restriction of neck movements and no anticipated difficult airway. Systemic examination was unremarkable, except for neurological findings such as increased tone in lower limbs with mild weakness, scissoring of lower limbs and toe walking. The findings were consistent with a diagnosis of spastic diplegia. Routine preoperative investigations were within normal limits. She was posted for botulinum therapy and casting for management of lower limb spasticity.

We planned to do the case under general anaesthesia, primarily on IV anaesthetic agents, with avoidance of inhalational anaesthetics, because of the risk of delayed emergence, hypothermia and a possible risk of malignant hyperthermia, which has been reported in isolated cases. Due to the child having mild mental retardation, she was given premedication in the preoperative room, in the presence of her parents, with Inj. Glycopyrrolate 60mcg IV, Inj. Ketamine 30mg IV, Inj.Fentanyl 15mcg. She was shifted to the operating theatre and standard monitors such as SpO2, NIBP, ECG, EtCO2 and temperature probes were attached. Patient was preoxygenated with 100% oxygen and induced with inj. Propofol 30 mg IV. After confirming adequate bag-mask ventilation, inj. Atracurium 8 mg IV was administered. The trachea was intubated with a 5 mmID microcuffed endotracheal tube. Tube placement was confirmed by capnography and bilateral chest auscultation. Mechanical ventilation was instituted in volume-controlled mode. Anaesthesia was maintained using propofol infusion via target-controlled infusion pump (Eleveld model), with target concentration of 2 microgram/ml and awake concenration of 1 microgram/ml, and titrated according to procedural requirements. The duration of the procedure was 1.5 hours and 15ml of 1% Propofol was required. The temperature was maintained in the range of 35.5- 36.5 degree celsius intraoperatively with appropriate use of forced air warmer and gamgee rolls covering the limbs. The intraoperative course remained uneventful with stable haemodynamics. The patient was also administered Inj. Dexamethasone 1.5mg IV, Inj. Ondansetron 1.5mg IV towards the end of the procedure to prevent post operative nausea and vomiting. At completion of the procedure, neuromuscular blockade was reversed using Neostigmine 0.75mg IV and Inj. Glycopyrrolate 120mcg IV. The child was extubated after ensuring adequate neuromuscular power and tone and shifted to the post-anaesthesia care unit. Recovery was uneventful.

DISCUSSION

Cerebral palsy is a group of permanent disorders of the development of movement and posture causing activity limitation, that are attributed to non-progressive disturbances that occurred in developing fetal or

infant brain. Children with cerebral palsy present with spasticity, developmental delay, communication difficulties, airway secretion burden, aspiration risk, musculoskeletal deformities, convulsions, visual and hearing defects.[2,3] Gastrointestinal problems such as gastroesophageal reflux disease are common and may cause respiratory complications.[2] Respiratory affections like recurrent pneumonia, aspiration and chronic lung disease are common in patients with cerebral palsy.[2,3]

Airway assessment should include evaluation for temporomandibular joint dysfunction, difficult laryngoscopy due to dental caries and loose teeth.[3] Epilepsy is commonly reported in cerebral palsy and anticonvulsants must be continued in the perioperative period.[3] Visual and hearing defects such as strabismus, myopia, retinopathy of prematurity and cortical blindness are noted in these cases.[3] Intellectual disability is commonly noted in nearly 50% of the cases and may vary from mild to severe.[3]

Chronic contractures and spasticity can cause difficulties in post-induction positioning of the patient , obtaining intravenous access, and performing regional anaesthetic techniques. Patients with contractures are usually started on baclofen therapy and physiotherapy. Baclofen is a GABA receptor agonist used to reduce pain associated with contractures. Baclofen overdose can cause drowsiness, respiratory depression and hypotonia, while abrupt cessation may precipitate seizures, hallucinations and dyskinesia; therefore, it should be continued perioperatively.[2,3]

In this patient, airway assessment was reassuring, allowing planned controlled induction. Premedication was given to reduce patient anxiety and the parents were kept by the child's side while premedication was administered. Premedication with glycopyrrolate was useful in reducing excessive secretions commonly encountered in cerebral palsy patients, while ketamine and fentanyl ensured adequate sedation, analgesia and haemodynamic stability.

Induction was performed with propofol, which decreases pharyngeal tone and provides smooth induction. Atracurium was selected for neuromuscular blockade due to its predictable metabolism and favourable safety profile. Altered responses to neuromuscular blocking agents have been described in children with cerebral palsy, including resistance to vecuronium and altered response to succinylcholine.[5,6]

One of the most important considerations in this case was the avoidance of volatile anaesthetic agents mainly because of the risk of delayed emergence due to low Minimum Alveolar Concentration (MAC) requirements for inhalational agents, and hypothermia due to impaired thermoregulation in these patients.[2,3] The patient may present with baseline hypothermia and the usage of gamgee rolls to cover the limbs, forced-air warmers and warm intravenous fluids helps counteract hypothermia.[2]

Maintenance of general anaesthesia with propofol infusion via target-controlled infusion pump allowed better control of anaesthetic depth, stable haemodynamics, smooth emergence and avoidance of volatile triggers. This approach proved effective and safe for the procedure.

CONCLUSION

Children with spastic cerebral palsy require individualized anaesthetic planning. General anaesthesia using propofol infusion via target-controlled infusion pump with avoidance of inhalational agents offers effective anaesthetic maintenance and smooth emergence from anaesthesia.

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