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ANESTHETIC MANAGEMENT OF A 6-YEAR-OLD CHILD WITH CEREBRAL PALSY UNDERGOING DENTAL SURGERY

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Abstract

Cerebral palsy (CP) is a group of non-progressive neurological disorders affecting posture and movement, mostly resulting from perinatal intrauterine disorders to the developing infant brain.

A 6-years old, male patient with spastic cerebral palsy (CP), which predominantly affected the right extremities more than the left ones, required dental surgical treatment of multiple tooth extractions and restorations, under general anesthesia. He received allogenic umbilical cord derived mesenchymal stem cells treatment one time, 6 months before the dental intervention.

The intervention under general anesthesia lasted approximately one hour and concluded successfully. Muscle relaxants were purposely avoided. The anesthesia was reversed and the patient was extubated successfully without complications and there was no sign of any adverse reactions postoperatively.

Key words: *Cerebral palsy, dental surgery, disabilities, general anesthesia, mesenchymal stem cells, pediatric patient*

Introduction

Cerebral palsy (CP) is a group of non-progressive neurological disorders affecting posture and movement, mostly resulting from perinatal intrauterine insult to the developing infant brain. Most cerebral palsy cases result from factors occurring before birth (antepartum). Conditions such as birth asphyxia, perinatal lack of oxygen, congenital abnormalities, bleeding within the brain's ventricles, and infections during pregnancy, all play a role in the development of CP. In developed countries, the rate of cerebral palsy in the general population is approximately 1 per 500 live births. Various CP-associated conditions often necessitate surgical procedures that require careful anesthetic management. Intraoperative challenges such as low blood volume, decreased body temperature, muscle spasms, seizures, and prolonged recovery can complicate anesthesia in these patients. A detailed preanesthetic assessment is essential for improving both intraoperative and postoperative care (1-5).

Historically, interventions for cerebral palsy have largely centered on medical and physical approaches, though evidence supporting their effectiveness has often been limited. By incorporat-

ing outcome measures that focus on quality of life and participation, treatments are now being developed that provide greater value and relevance to individuals with cerebral palsy and their caregivers (6).

For many years, cerebral palsy (CP) was primarily categorized based on a patient's resting muscle tone, such as hypertonic (spastic), dyskinetic, ataxic, or mixed types. However, this simplistic classification has been replaced by more comprehensive systems that consider a patient's motor function, level of physical activity, and psychosocial capabilities. These updated classifications allow clinicians to plan daily care strategies to better meet the unique needs of each patient (7).

The clinical manifestation can vary widely, from mild monoplegia with normal intellectual function to severe full-body spasticity accompanied by intellectual disability. The shared characteristic is a motor impairment caused by a non-progressive brain lesion or abnormality that appears early in life (8).

Children with cerebral palsy (CP) often require specialized care during preoperative preparation and assessment to anesthesia approach due to underlying neurological, respiratory, and musculoskeletal issues. Anesthetic management for these patients requires attention to specific physiological considerations and potential medication interactions with the underlying disease (9).

Case report

This article presents a case report of a 6-year-old male patient with spastic cerebral palsy (CP), which predominantly affected the right extremities more than the left ones, who required dental treatment of multiple tooth extractions and restorations under general anesthesia. Our patient had a stroke in the early postpartum period, affecting the left cerebral hemisphere, resulting in weakness in the right arm and leg. He has undergone various diagnostic procedures and treatments, including rehabilitation. Six months before, he received allogenic umbilical cord derived mesenchymal stem cells for cerebral palsy with intrathecal, intravenous, and intramuscular administration at the Regenerative Medicine and Stem Cell Production Center under general anesthesia, which have provided partial improvements.

The child was born following a normal and well-monitored pregnancy, delivered at term, spontaneously in a cephalic presentation, with a birth weight of 4100 grams and length of 56 cm, and with a 9/10 Apgar score. Soon after birth, skin color changes and respiratory issues were noted, suspected to be related to possible aspiration of amniotic fluid. The child was placed on oxygen, and a chest X-ray showed slight changes in the lungs. During the night, the child experienced apnea episodes, wheezing, and movements of the right arm resembling spasms. The condition progressed to body stiffness and cyanosis, while a cranial ultrasound showed no signs of bleeding. An EEG was immediately performed, revealing changes over the left hemisphere, prompting the initiation of therapy to stabilize the EEG findings. Later, an MRI revealed a thrombus measuring 6 mm in the middle region of the left hemisphere. Seizures began 7 hours after birth, and a central thrombus was diagnosed in this early postpartum period, leading to a diagnosis of CP. Since then, over the following six months, the patient was placed on levetiracetam (Keppra) for seizure prevention and has been receiving regular follow-up care. The family history is unremarkable. He had developmental follow-up, physical therapy, and exercises monitored by a pediatric neurologist.

The child was brought in for an anesthesia examination and consultation for dental surgery. On the examination, the patient was a 6-year-old child weighing 20 kg, with a normal outward appearance, cheerful and curious demeanor, good facial expression, well-nourished and well-cared-for. The head was normocranial, the bulbi was normopositioned, there was no nystagmus, pupils were isochoric with preserved visual motor reflexes (VMR). There were no clear signs of facial muscle weakness at rest or during activity. He showed weakness of the orofacial musculature: right-sided hemiparesis with increased muscle tone (MTR) and hyperreflexia, with a predominance of flexor muscles in the right upper extremity and extensor muscles in the left upper extremity. The patient had no control over sphincters. Occasionally, minimal cognitive blocks were observed. There were obstacles in the sensory integration.

The child sits independently, crawls, and walks with support. It was deemed that the caries would develop rapidly due to the patient's poor oral hygiene status and that performing dental procedures on multiple teeth using local anesthesia would be difficult due to the patient's lack of ability to cooperate. As a result, general anesthesia was chosen for the purpose of behavior management. His parents were well informed about the method, process, and side effects of the anesthesia and dental procedures. Then, a consent form was signed prior to the inpatient general anesthesia procedure. A preoperative complete blood examination was performed. At this time, the patient was not taking any medications.

The patient received a prophylactic dose of antibiotic, administered via intravenous drip over 15 minutes, one hour prior to the procedure. In the operating room, the patient was positioned supine, and standard monitoring equipment for SpO_2, noninvasive blood pressure, and electrocardiogram was attached. Suction devices were prepared to manage potential regurgitation or aspiration. The patient's head was elevated to a 30°–40° angle, and oxygen was delivered at a flow rate of 8 L/min. A mask was gently placed over the mouth and nose, ensuring no additional pressure, and oxygen was inhaled continuously for 5 minutes. After administering oxygen therapy, the induction of anesthesia was performed with 1 mg midazolam and 40 mg propofol titrated to loss of consciousness (we didn't use a higher dose up to 3.5 mg/kg because he wasn't on chronic anticonvulsants to have enzyme induction). A cuffed endotracheal tube of size 4.0 was used for intubation. Correct tube placement was verified using a capnograph and auscultation. Anesthesia was maintained with 2% sevoflurane and fentanyl, ensuring there was no patient movement or spontaneous respiration during the procedure. Muscle relaxants were not used. The patient received 500 ml of intraoperative fluids. The surgery lasted approximately one hour and concluded successfully. The patient was extubated without complications and showed no adverse reactions postoperatively. After the dental procedure, the patient was discharged home the same day in stable condition, with no signs of postoperative complications.

Discussion

Individuals with cerebral palsy often face complex dental challenges due to issues such as poor lip seal, higher rates of malocclusion, temporomandibular joint disorders, and swallowing difficulties. Motor dysfunction conditions such as cerebral palsy causing uncontrolled tremors often require general anesthesia to facilitate keeping the mouth open for dental procedures. Maintaining the airway during anesthesia induction can be challenging due to excessive secretions. Responses to anesthetic agents may vary, and patients may show resistance to non-depolarizing muscle relaxants. In our case we didn't use muscle relaxants. Clinicians can minimize risks while

optimizing outcomes in these patients by avoiding benzodiazepines and muscle relaxants in anesthesia and careful consideration to ensure patient safety by adhering to principles of safe anesthesia (10).

The severity of cerebral palsy before surgery seems to be closely linked to the risk of complications after the procedure. Wass CT, et al. in their study aimed to evaluate the prevalence of perioperative morbidity and mortality in patients with cerebral palsy undergoing anesthesia through a systematic review of the Mayo Database. The risk for perioperative adverse events was 63.1% (95% confidence interval 59.8%-66.5%). Notably, hypothermia and clinically significant but non–life-threatening hypotension accounted for 80% of these complications. Excluding these two events, the incidence of adverse perioperative outcomes was 13.1% (95% confidence interval: 10.8%-15.5%). Factors contributing to higher risk included an ASA (American Society of Anesthesiologists) physical status score of 2 or higher, a history of seizures, upper airway hypotonia, undergoing general surgery, and being an adult. These results provide valuable insight for counseling patients with cerebral palsy, their families, and caregivers about the risks associated with general anesthesia. In our case, the patient underwent ambulatory anesthesia uneventfully, with a stable axillary body temperature of 36.0 °C (11).

In the coming years, stem cells are expected to play an increasingly significant role in the treatment of neurodevelopmental disorders such as cerebral palsy (CP). Stem cell therapies hold great promise due to their remarkable regenerative capabilities and immunomodulatory properties. However, discrepancies in clinical studies regarding the route of administration, cell sources, and dosing protocols make it challenging to establish standardized practices that optimize therapeutic benefits while minimizing side effects. A critical and intriguing area of focus is the long-term safety and effectiveness of stem cell therapies for CP. Current knowledge remains limited, particularly regarding long-term outcomes in pediatric patients, as most clinical trials have relatively short follow-up periods. Further research is essential to thoroughly evaluate the sustained safety and efficacy of these treatments in children. In this case, six months before the dental procedure, our patient received allogenic umbilical cord derived mesenchymal stem cells for cerebral palsy with intrathecal, intravenous, and intramuscular administration at the Regenerative Medicine and Stem Cell Production Center under general anesthesia, which have provided partial improvements (12).

Escanilla-Casal, et al. in their comparative study between two groups, one of healthy children and the other of children with cerebral palsy, who underwent dental treatment under general anesthesia, compared and determined oral pathology, frequency, severity and postoperative complications in pediatric patients with and without an underlying disease who undergo a dental treatment under general anesthesia. It was concluded that as for postoperative complications recorded on the questionnaire after the first day, the CP group experienced more bleeding and showed higher sleepiness ($p<.05$). On the contrary, our patient experienced neither bleeding nor reported any sleep-related issues (13).

Conclusion:

Cerebral palsy presents unique perioperative challenges that require careful anesthetic planning, individualized technique selection, and vigilant intraoperative and postoperative monitoring. Effective collaboration with the patient and caregivers is essential to ensure optimal

preparation and management, particularly when standard agents such as benzodiazepines and muscle relaxants are avoided. A tailored, safety-focused, and patient-centered approach can lead to successful anesthesia outcomes even in complex cases, underscoring the importance of flexibility and multidisciplinary coordination in care.

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