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CASE REPORT

Successful Anesthetic Management of Patient with Severe Scoliosis Due to Cerebral Palsy Who Underwent Dental Surgery

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Abstract: Patients with cerebral palsy may have intellectual disabilities, convulsions, scoliosis, or thoracic deformities. Scoliosis is a complex deformity of the spine resulting in secondary involvement of the respiratory, cardiovascular and neurologic systems which may affect the anesthesia for those patients We reported a case of a 17-year-old female with cerebral palsy and severe scoliosis who presented for dental caries operation under general anesthesia. General anesthesia was conducted, difficult airway management sets have been prepared, and pressure control ventilation to minimize peak airway pressure was adopted. Anesthetic management was performed without anesthesia-related complications. We recognize that considerable attention is required in patients with cerebral palsy. Perioperative management and general anesthesia of patients with cerebral palsy who have severe scoliosis represent significant challenges. Multidisciplinary approach through team included surgeons, anesthesiologists, neurophysiologists, pediatricians, nurses, nutritionists, and physiotherapists is required.

Keywords: scoliosis, general anesthesia, cerebral palsy, oxygenation

Introduction

Cerebral palsy (CP) is a wide-spectrum syndrome that describes a various group of neuromuscular disorders characterized by variables degrees of sensory, motor, and intellectual impairment. The estimated prevalence of deliveries complicated with CP was 10% by the National Institute of Neurological Disorders and Stroke. Because of the advancement in healthcare provided for patients with CP, the life expectancy of many patients with CP now extends into adulthood. Accordingly, they frequently presented with complicated health issue that necessitated both specialized and general hospitals for anesthesia and surgery.[1]

As the CP is a neuromuscular disorder, a strong association was established between CP and scoliosis. About 21–64% of patients with CP were documented to have scoliosis.[2–4] In several studies, the levels of general and global disability in patients with CP, such as spasticity, muscle weakness, and poor muscle control, was linked to the development of scoliosis.[5] Scoliosis is a complex spinal deformity with rotation of the vertebrae, significant lateral curvature, and malformation of the rib cage.[6–8] Secondary respiratory, neurological, cardiovascular, and visceral involvement by scoliosis may complicate and affect anesthesia in those patients and complicate their life expectancy.[9] Dental procedures even augment these risks as the patients lack the required cooperation, the airway would be shared for both surgical procedure and anesthesia, and risk of secretions. Here, we report successful anesthetic management in a patient with CP and subsequent severe scoliosis. This case presentation emphasizes the critical importance of careful airway assessment, ventilation strategy, and multidisciplinary planning to minimize perioperative complications in similar patients.

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Case Report

A 17-year-old, female patient with height, 132 cm; weight, 25 kg) with a history of cerebral palsy, profound intellectual disability, and seizure disorders presented to the dental department. Due to the intellectual disability and low level of cooperation, performing dental procedures on multiple teeth under local anesthesia was difficult. Therefore, general anesthesia was decided. Her mother, the patient's primary caregiver, was well informed about the procedure, anesthesia, and possible side effects. Then, a detailed consent form was signed. Owing to her medical condition, the patient was admitted to the hospital two days before the dental procedure for further evaluation by the anesthetic team.

Airway assessment revealed Mallampati Grade II, adequate mouth opening, normal temporomandibular joint, and full range of neck movements. Examination of the spine revealed lateral curvature along with thoracic scoliosis (Figure 1). Bilateral normal vesicular breath sounds were heard on chest examination. Chest radiography was then performed (Figure 2). Hematological investigation revealed a hemoglobin of 9.5 g/dl. Arterial blood gas on room air showed PCO2 −42 mmHg and PO2 −70 mmHg.

In the operating theater, routine non-invasive monitoring was conducted and included heart rate, blood pressure, electrocardiography, and pulse oximetry. Her baseline blood pressure and heart rate were 106/75 mmHg and 102/min, respectively. Her SpO2 was 91% while breathing room air, and ECG results showed a normal sinus rhythm.

The decision was to proceed with general anesthesia with nasal intubation to obtain an adequate surgical field view. Difficult airway management tools have been developed (due to scoliosis, and any potential for hidden airway difficulties in cerebral palsy). After preoxygenation with 100% O2 at 10 L/min for 5 min, induction was performed with intravenous (IV) injection of propofol 2.5 mg/kg until loss of response to verbal command with fentanyl 2.5 mic/kg. Atracurium 0.5 mg/kg IV was administered to facilitate endotracheal intubation. Direct laryngoscopy was performed using a Macintosh Blade No. 3. After intubation with a #6.0 endotracheal tube (ETT), temporary fixation 22 cm from the right nostril was established, and fiberoptic was unavailable to check the depth of the ETT bronchoscopy. The depth was confirmed through bilateral chest movement, auscultation, and capnography. Anesthesia was maintained with a fresh gas flow of 2 L/min of 50:50 (N2O:O2) and 2% sevoflurane. Pressure control ventilation to minimize peak airway pressure with a high rate and low tidal volume was utilized with the following settings: inspiratory pressure was 12 cm H2O to achieve a tidal volume of 6 mL/kg with a respiratory rate of 16–18 breath/min. Based on arterial blood gas analysis during the intraoperative period, ventilator parameters were managed to maintain normocapnia and adequate oxygenation. Arterial blood gas revealed Ph of 7.48, PCO2 of 45 mmHg, and PaO2 of 138 mmHg. During the extubation, the heart rate was 102 beats/min, accordingly atropine was not utilized, and suction catheter was used to clear and handle the pharyngeal secretions. A hydrocortisone injection was used to prevent airway hyperactivity and laryngeal edema at a dose of 2 mg/kg. We administered 20 mg/kg paracetamol and encouraged the surgeon to administer local anesthesia.

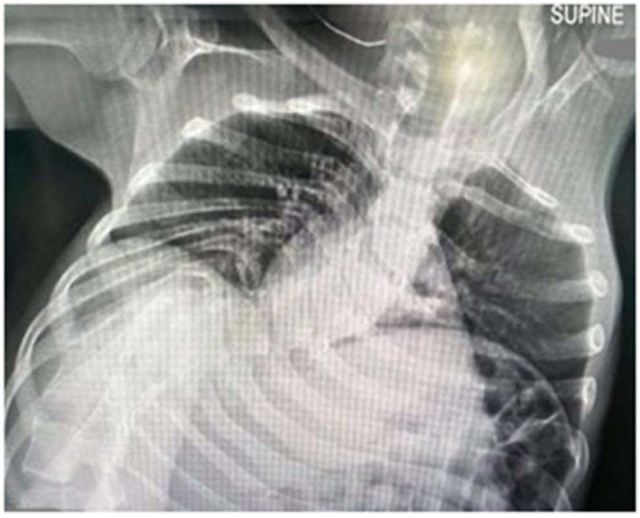

Figure 1 Plain chest radiograph (anteroposterior view) showing a scoliosis of the thoracolumber vertebra.

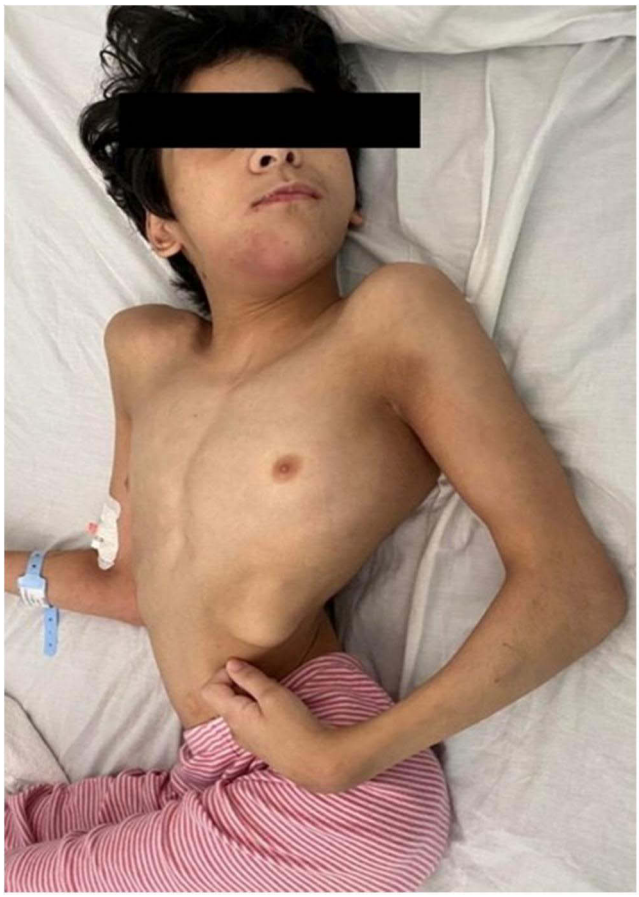

Figure 2 Severe scoliosis.

Good physiotherapy was performed before extubation, which was performed in the sitting position. The extubation was initiated after confirming the airway patency, adequate consciousness, strong cough reflexes, appropriate level of ventilation, and hemodynamic stability.

After surgery, the patient was monitored closely for 2 h in the postoperative room and on the floor for 12 h. post-operative period was uneventful.

Discussion

Many patients with CP present with intellectual disability, convulsions, scoliosis, and thoracic deformities. Jeong and Choi reported the case of a 22-year-old male with cerebral palsy accompanied by a high degree of mental retardation and scoliosis, who had advanced dental caries therapy and underwent successful general anesthetic management.[10] In this case, anesthetic management focused on maintaining respiratory function during the perioperative period and preventing postoperative complications.

In the present case, the patient had scoliosis in the thoracolumbar region. Patients with scoliosis suffer from restrictive lung disease, which involves decreased vital capacity, functional residual capacity, tidal volume, and an increased respiratory rate.[11] The severity of pulmonary impairment depends on the Cobb's angle, the number of vertebrae involved, and the cephalic location of the curvature.[12] Therefore, we used pressure-controlled ventilation to minimize peak airway pressure at a high rate and low tidal volume.

Key preoperative considerations for patients with CP include managing anxiety; optimizing hydration, nutrition, and cardiorespiratory function; continuing drug therapy, such as anti-epileptic medication during the perioperative period; and postoperative analgesia.[1] Regarding the hemodynamic stability, the patient had a hemoglobin level of 9.5 g/dl. The following guideline was adopted regarding the need for transfusion, if hemoglobin level is < 7.0 g/dl or if < 10g/dl with

anemia symptoms and signs, the transfusion would be indicated. The patient was assessed by a hematologist preoperatively and advised to proceed to surgery without transfusion.

Contractures may complicate positioning and intravenous access. The airway should be properly assessed for the severity of airway obstruction because, as age increases, hypotonia of the pharyngeal musculature.[13] These children have impaired ability to handle pharyngeal secretions. This is due to the hyperactive salivary glands and impaired cranial nerve function. Therefore, use of anticholinergic drugs is essential. Unfortunately, atropine is the only anticholinergic drug available at our hospital. However, the patient had tachycardia with an HR of 102 beats/min; therefore, we used a suction catheter to clear and handle the pharyngeal secretions. The unavailability of other anticholinergics such as glycopyrrolate that has lesser effects on the central nervous system and lower potential for tachycardia is a limitation that could be solved by enhanced suction. A hydrocortisone injection was used to prevent airway hyperactivity and laryngeal edema at a dose of 2 mg/kg. Good physiotherapy and analgesia are vital to achieve sputum clearance. We administered 20 mg/kg paracetamol and encouraged the surgeon to administer local anesthesia. Good physiotherapy was performed before extubation, which was performed in the sitting position. The life expectancy of patients with CP extends into adulthood. Thus, it is increasingly likely that anesthesiologists will encounter patients with CP during their careers. Therefore, practicing anesthesiologists should have a comprehensive understanding of this broad spectrum of disorders and provide exceptional and personalized perioperative care.

In conclusion, this is a report of unique case of successful anesthesia management for dental procedure in a patient with severe CP, scoliosis, anemia, and with the absence of proper anticholinergics. In patients with CP, difficult airway settings should always be prepared, even if the airway appears normal. Moreover, in patients with restrictive lung disease, pressure-controlled ventilation and arterial blood gas monitoring would be of vital importance. Access to ideal anticholinergic agents (such as glycopyrrolate) for secretion management should be ensured. Anesthesia and perioperative management of patients with scoliosis represent significant challenges for healthcare providers. The multidisciplinary team included surgeons, anesthesiologists, neurophysiologists, pediatricians, nurses, nutritionists, and physiotherapists. The management plan should be carefully adjusted due to the high risk of perioperative complications.

Data Sharing Statement

Data supporting the findings of this study are available from the corresponding author upon reasonable request.

Ethics Approval

Institutional review board is not required for this type of article.

Consent for Publication

Written informed consent was obtained from the patient's parents for the publication of this case report and accompanying images. A copy of the written consent form is available for review by a journal. We confirmed that the privacy of the participants was preserved and that the data were anonymized and kept confidential.

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Disclosure

The authors declare that they have no competing interests.

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