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Case Report

Anesthesia Management of a Child with Laryngeal Malacia

Ruixue Li*

Department of Anesthesiology, West China Hospital, Sichuan University and the Research Units of West China, Chinese Academy of Medical Sciences, Chengdu, China

Abstract

Laryngeal malacia is the most common disease causing laryngeal wheezing in infants and young children, and its pathogenesis is not clear at present. We report the case of a child with congenital laryngomalacia who underwent general anesthesia and successfully completed laryngeal reconstruction and plastic surgery. Physical examination of the patient revealed depression of the suprasternal notch during inspiration. Preoperative imaging studies and laryngoscopy indicated laryngomalacia and airway stenosis. Preoperative anesthesia assessment suggested potential difficulty with mask ventilation and intubation. Due to the patient being a young infant unable to follow commands in a conscious state for tracheal intubation, the final decision was made to use general anesthesia that maintains spontaneous breathing under sedation for anesthesia induction. Given the young age of the pediatric patient, high airway reactivity, and tendency for edema, a method was employed that involved administering steroids, anticholinergic drugs, and local anesthetics via nebulization before general anesthesia. This approach significantly reduced airway reactivity and decreased airway secretions. And we chose a smaller tracheal tube to establish an artificial airway. Anesthesia is induced by full local airway anesthesia, full sedation, and maintenance of spontaneous respiration, maintained during anesthesia with inhalation and intravenous anesthesia drugs. The entire anesthesia induction process did not show signs of hypoxia in the child. The operation was successfully completed and the extubation was successful 11 days after surgery.

Keywords

Laryngomalacia, Childgeneral, Anesthesia

1. Introduction

Laryngomalacia is the most common congenital laryngeal malformation, caused by partial or total collapse of the upper laryngeal cartilage into the airway during inspiration, resulting in upper respiratory tract obstruction [1]. Anatomical abnormalities of the laryngeal cartilage include elongated epiglottis or softening, arytenoid cartilage mucosa, aryepiglottic fold, corniculate cartilage mucosa, and cuneiform cartilage mucosa, among other supraglottic structures, collapsing towards the glottis during inspiration [2]. The main clinical manifestation is inspiratory laryngeal wheezing, which is usually caused by feeding, crying, lying on the back or suffering, and also includes different symptoms and signs, including supravicular and intercostal inspiratory retraction, hoatiness, aphonia, dyspnea and feeding problems, accounting for about 58% to 74% of newborns and infants [3]. Diagnosis can be made based on clinical history and physical examination, as well as lung function tests, computed tomography, dynamic magnetic resonance imaging, and bron-

*Corresponding author: 2027581940@qq.com (Ruixue Li)

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chofiberscopy [4]. Fiber-optic laryngoscopy is the gold standard for diagnosing laryngomalacia, but it also has significant drawbacks, including laryngospasm, patient discomfort, and high cost risks [5]. Recent studies have shown that using laryngeal ultrasound to evaluate the arytenoid cartilage angle during abduction (≤120°) and detecting arytenoid adduction or vocal cord collapse during inspiration can assist in diagnosing infant laryngomalacia, complementing the gold standard fiber-optic laryngoscopy [6]. Laryngomalacia is usually a self-limiting disease. In children with mild to moderate laryngomalacia, the condition can be gradually improved and recovered with age by adjusting the position and changing the feeding method. In children with severe laryngomalacia, surgery is mainly performed, mainly by supratroglottoplasty, which can improve the abnormal anatomical morphology of laryngeal cartilage. The success rate of operation is as high as 86.1% ~ 89.0% [7, 8].

Airway abnormalities exist in children with laryngomalacia, which is particularly important for airway management in the whole perioperative period. There are four main anesthesia methods for the management of anesthesia in children with difficult airway: general anesthesia plus intravenous maintenance, inhalation induction, high frequency jet ventilation, and finally local anesthetic sedation [9, 10]. The selection and management of the correct anesthesia method is of great significance to improve the treatment rate of children. We describe the management of general anesthesia in a child with laryngeal malacia undergoing laryngeal reconstruction and plastic surgery.

2. Case Presentation

The patient is an infant aged 8 months and 5 days, weighing 7kg and standing 65.1cm tall. The child had a full-term birth, and the weight increased with growth and development (the child protection showed slightly poor development). He was admitted to hospital for "hoarse voice for more than 8 months and repeated laryngeal wheezing for 6 months". After birth, the child had a slight hoarseness, occasional coughing after eating, no cyanosis of the mouth and lip, no obvious throat wheezing and other discomfort, and was considered to be "laryngeal dysplasia", and no special diagnosis and treatment was given. At the age of 2 months, the child developed sputum sound without obvious inducement, accompanied by laryngeal wheezing, choking without sleep and other symptoms, and was diagnosed as "acute laryngitis, severe pneumonia, second-degree laryngeal obstruction, laryngeal chondrodysplasia" in another hospital and hospitalized. After anti-inflammatory treatment, the symptoms of tachypnea improved, but there were still sputum sounds and laryngeal wheezing symptoms. At the age of 4 months, the child had breathlessness when eating too fast or too much, accompanied by cyanosis of the mouth and lips, and the symptoms could be relieved after stopping eating and patting the back. Before admission, the patient had symptoms such as suffocation and awakening during sleep, coughing while eating, and breathing difficulty during activity, and was then admitted to hospital.

Physical examination after admission showed that the patient had suprastnal fossa, supraclavicular fossa and costal space depression during strenuous breathing. Laryngoscopy showed that the left arytenoid area was coiled close to the vocal cords, and the left arytenoid area protrusion was obvious when the glottis was closed, and the glottis was incomplete. Laryngeal malacia?. The Computed Tomography (CT) and X-ray results indicate the narrowest point is approximately 3.2 mm. No significant abnormalities were found in other Electrocardiogram (ECG), complete blood counts, coagulation tests, etc.

After the patients were admitted to the operating room, they were immediately monitored with pulse oximetry, electrocardiogram and non-invasive blood pressure. Preoperative vital signs showed blood pressure 120/55mmHg, pulse rate 150 times/min, respiratory rate 30 times/min, and blood oxygen saturation 99%. Surgeons are standing by in the operating room, ready to perform an emergency tracheotomy if necessary. Before anesthesia induction, dexamethasone 2mg, penehyclidine hydrochloride 0.2mg and 2% lidocaine 2ml were atomized for 10min. 10min later, dexamethasone 2mg and atropine 0.07mg were given through peripheral vein, oxygen was given 5L/min by mask, and sevoflurane 5% was inhaled for anesthesia induction, so as to maintain sufficient depth of anesthesia and avoid loss of spontaneous respiration. After confirming that the child had no difficulty breathing with a mask, 3.5mg esketamine was administered intravenously and 10mg tetracaine was sprayed with a laryngoscope and laryngeal surface anesthesia was performed. At the same time, the concentration of inhaled sevoflurane was adjusted to 3% according to the spontaneous breathing of the children. 10min later, Esketamine 1mg and fentanyl 5ug were added intravenously to deepen the depth of anesthesia while maintaining the state of spontaneous breathing. A 3.5-gauge tracheal catheter was successfully inserted under the guidance of visual laryngoscope, and the depth of intubation was 13cm. After confirming successful intubation, fentanyl 5ug and cis-atracurium 0.7mg were added intravenously. After intubation, the depth of anesthesia was maintained by inhalation of 5% sevoflurane and continuous intravenous infusion of 0.1ug/kg. min remifentanil, with 0.7mg cisatracurium added once. The whole operation lasted for 100min, and the patient received a total of 60ml of fluid.

After a comprehensive evaluation, it was considered more appropriate for the child to enter the intensive care unit. After sputum aspiration, the child was transferred to the Intensive Care Unit (ICU) for further treatment. After the patient was transferred to ICU, he continued to use the ventilator to assist breathing, and enhanced hormone anti-inflammatory and antibiotic anti-infection treatment. On the 4th day after the operation, the tracheal intubation was removed after evaluation. A few minutes after the extubation, the child

showed labored breathing and obvious three concave signs. No relief was found after sputum aspiration, and the tracheal intubation was re-applied and transferred to the Pediatric Intensive Care Unit (PICU) for further treatment. 11 days after the operation, the patient was successfully extubed, given lateral budesonide atomization and oxygen therapy, transferred to the general ward and discharged. The patient continued to be followed up by the Ear, Nose, and Throat (ENT) department in our hospital.

3. Discussion

Laryngomalacia is the collapse of the upper laryngeal structure, which not only causes wheezing, but also causes difficulty in ventilation and intubation during anesthesia management. Difficulties with ventilation and tracheal intubation are often associated with hypoxemia, which can be a life-threatening risk factor for arrhythmia, brain damage and even death [11].

For anticipated difficult airways such as laryngomalacia, guidelines recommend awake tracheal intubation and sedation under general anesthesia while preserving spontaneous breathing and avoiding neuromuscular blocking agents (NMBA). However, for this uncooperative infant patient, performing awake tracheal intubation was challenging. After excluding ventilation difficulties, we considered tracheal intubation while preserving spontaneous breathing. Tracheal intubation with preserved spontaneous breathing requires adequate depth of sedation and sufficient effective topical anesthesia of the airway surface. Topical anesthesia of the airway can be achieved through methods such as spraying, mouthwash, lozenges, aerosols, or cotton swabs soaked in local anesthetics, which are less invasive compared to nerve blocks [12]. Therefore, we used nebulized steroids and lidocaine for local anesthesia and sprayed dyclonine on the airway surface, achieving anti-inflammatory and local airway anesthesia effects. Propofol was not used because high doses may suppress respiration, whereas ketamine can maintain spontaneous ventilation even at high doses [13]. Adequate depth of sedation was achieved by inducing with ketamine and maintaining with inhalational isoflurane. Atropine was also used to reduce secretions caused by ketamine. Muscle relaxants and analgesics should be added after confirming successful intubation. The entire anesthesia and intubation process was well tolerated by the child, with minimal coughing, small fluctuations in blood pressure and heart rate, and the surgery was successfully completed.

For children who have undergone laryngomalacia surgery, mastering the timing of extubation is particularly important, which is also worth researching. For children with obvious postoperative airway obstruction, non-invasive positive pressure ventilation can be chosen to reduce the risk of re-intubation or even tracheostomy. According to literature reports, two children with severe laryngomalacia showed good results after using non-invasive positive pressure ventilation for six months following [14]. For severe cases of laryngomalacia, endoscopic laryngoplasty is the preferred treatment method, with high success rates. However, many factors significantly impact surgical outcomes besides anesthesia management strategies, such as prematurity, low birth weight, and medical complications [15]. The patient received hormone nebulization, antibiotic anti-infection, and high-flow oxygen therapy after re-extubation and was successfully discharged. We will continue to follow up on this child.

4. Conclusion

Figure 1. *During inspiration, there is a depression in the suprasternal notch.*

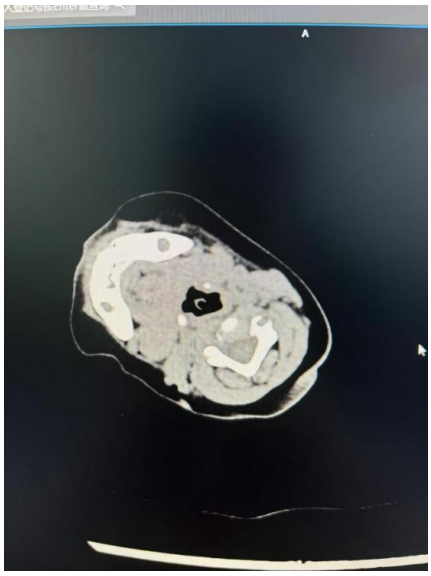

Figure 2. *CT shows underdevelopment of the laryngeal cartilage.*

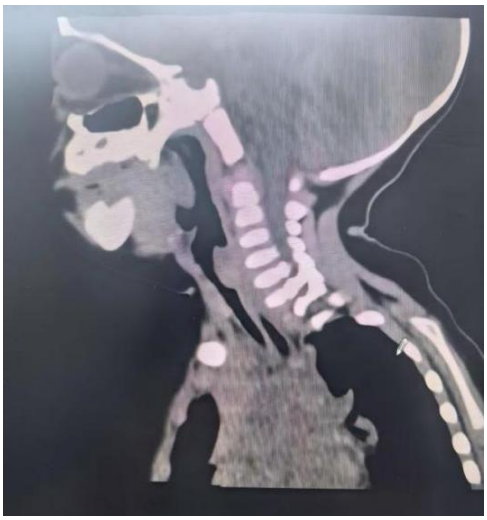

Figure 3. *X-ray shows airway stenosis.*

This report documents the management of anesthesia during surgery in an 8-month-old child with laryngeal malacia. For the anesthesia management of laryngomalacia patients, it is necessary to fully evaluate the severity of difficult airway before surgery, improve the preparation before anesthesia, select the correct anesthesia method, and prepare for emergency airway establishment. In this case, lidocaine atomization and tetracaine surface anesthesia were used to complete local airway anesthesia, esketamine combined with sevoflurane was used to sevoflurane sedation and small doses of fentanyl were used to preserve spontaneous breathing, and anesthesia intubation was successfully completed under visual laryngoscope. The whole process of anesthesia induction and maintenance was smooth, and the patient successfully completed the operation. It can provide reference for anesthesia management of laryngomalacia patients.

Abbreviations

CT	Computed Tomography
ECG	Electrocardiogram
ICU	Intensive Care Unit
PICU	Pediatric Intensive Care Unit
ENT	Ear, Nose, and Throat

Author Contributions

Ruixue Li is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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