

Use of CobraPLUSTM in a child with tracheomalacia

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Citation

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Abstract

We present a case of a 6 month old, ex premature patient with tracheomalacia and a long history of difficult weaning from mechanical ventilation after repeated surgeries under general anaesthesia. For the current procedure he was successfully managed using a size 1/2 Cobra PLUS™ extraglottic airway. This is the first report of using this device in a patient. The features of Cobra PLUS™ are described and the implications of tracheomalacia and anaesthesia are shortly discussed.

INTRODUCTION

Airway management in ex premature babies suffering from chronic lung disease and tracheomalacia is challenging. We present the successful use of the CobraPLUS (a new second generation CobraPLA™ extraglottic airway device) for anaesthetic management of a child who suffered from tracheomalacia necessitating prolonged mechanical ventilation during prior anaesthesia.

CASE REPORT

A 6month old, 3.195 g ex premature (born at 24 weeks, 550 g) infant was scheduled for diode laser retinal repair due to retinal detachment.

The baby had a history of severe RDS that became complicated with chronic lung disease. He was ventilated continuously for 2 months following birth, including 2 weeks with high frequency ventilation. After he was weaned from the ventilator he had to undergo 5 surgeries including four diode laser surgery and a Nissen fundoplication. After each of these procedures he was ventilated for prolonged periods of time making a total time of mechanical ventilation of 4 months. Before each prior extubation trial he became agitated and had a tendency to airway collapse due to tracheomalacia, with near total airway collapse confirmed by fiberoptic bronchoscopy on several separate occasions.

In addition, he had a history of apnoea of prematurity and a PDA that was closed with indomethacin treatment at 6 weeks of age.

His last diode laser surgery was three weeks prior to the present procedure, and after that procedure surgery he

remained intubated for sixteen days. Since the last extubation, he was maintained on oxygen by nasal cannula at 2 l/min. His SpO₂ was 92%. The child had a respiratory rate of 50 breaths per minute (bpm), blood pressure of 73/40 mmHg and pulse of 178 beats/min. Expiration was relatively prolonged but no wheezing was audible. A capillary blood gas done the morning of surgery showed a PaCO₂ of 56 mmHg and a Standard bicarbonate level of 35 mEq/L. His medications consisted of albuterol, hydrochlorothiazide, spironolactone and prednisone.

Due to the patient's history of prolonged ventilation following each surgery, we decided to use an extraglottic device for his airway management and we specifically chose the new CobraPLUS™ airway (Engineered Medical Systems, Indianapolis, IN). After applying standard monitors, anaesthesia was induced with sevoflurane to an end tidal concentration of 2%. We decided to use a slow gas induction because we believed this would provide a better chance of preserving spontaneous breathing. A CobraPLUS™ size 1/2 disposable extraglottic airway was easily placed and the cuff was inflated until a leak at 18 cm H₂O was audible. Anaesthesia was maintained with sevoflurane in air and oxygen 60/40%. After placement of the CobraPLUS™, the respiratory efforts were judged to be weak; therefore, the ventilation was supported by using the Narcomed 6400's Synchronized Intermittent Mandatory Ventilation mode with a respiratory rate of 20 bpm. Throughout the 65 minute procedure, the SpO₂ ranged between 90 and 92% and the ET-CO₂ from 55-62 mm Hg, while hemodynamics remained stable. Core temperature as measured by the thermistor on the CobraPLUS™ cuff, ranged between 35.8 and 37.6°C. At the end of the

procedure caffeine citrate 40 mg was administered, the FiO_2 was increased to 1.0, sevoflurane was discontinued, and the CobraPLUS™ was removed while the infant was breathing spontaneously. He was transported to the Neonatal Intensive Care Unit (NICU) with oxygen administered by face mask, at 4 l/min. His SpO_2 immediately after removal of the CobraPLUS™ and in the NICU ranged between 94 and 96%. Over the next 12 hours, the child was switched back to his basal oxygen flow rate without deterioration of his respiratory status. He was discharged to another hospital 3 weeks after surgery.

DISCUSSION

Tracheobronchomalacia in children is a rare yet serious condition associated with high mortality [1]. This condition is becoming an increasingly recognized clinical entity that often requires prolonged intubation and mechanical ventilation. Tracheomalacia and bronchomalacia refer to excessive softness and collapsibility of the tracheal and bronchial cartilages, respectively. The combination of these two pathologies is termed tracheobronchomalacia. These conditions may coexist with laryngomalacia or generalized chondromalacia. In most cases of airway malacia, the defects are intrathoracic. As a result, during forceful expiration or coughing, when intrathoracic pressure becomes positive, the affected segment of trachea or bronchus narrows, resulting in an audible wheeze. In the less common situation of cervical (extrathoracic) tracheomalacia, airway collapse takes place during inspiration. In this setting, negative intrathoracic pressure is transmitted to the upper airway that then narrows, causing inspiratory stridor.

Airway malacia is usually associated with bronchopulmonary dysplasia, tracheo-esophageal malformations and major aorto-pulmonary malformations. Tracheomalacia is also a significant reason for need for long-term tracheostomy in children and has been implicated as a poorly recognized cause of Sudden Infant Death Syndrome [2].

Surprisingly, there is little information in the anaesthesia literature referring to this condition. Most of the publications are case reports with only one review article published by Austin and Ali in 2003 [1]. These authors recommend three possible anaesthetic options (depending on the type of surgery): sedation with topical anaesthesia, general anaesthesia with inhalational or general anaesthesia with intravenous maintenance. While there is no good evidence to support any particular technique, the avoidance of tracheal

intubation by use of the laryngeal mask airway [3] may decrease postoperative coughing and the risk of airway collapse upon emergence from anaesthesia. “Deep” extubation may also allow a smoother recovery.

Our patient had tracheomalacia and had required mechanical ventilatory support for prolonged periods of time after previous anaesthesia. Extubation failed repeatedly due to agitation and exaggerated airway collapsibility. Although there is a theoretical risk of airway obstruction during general anaesthesia with the airway managed without tracheal intubation, in patients with collapsible airways [4], there have been several reports of using a laryngeal mask for diagnostic bronchoscopy with [5,6,7,8] or without recognized tracheomalacia [9].

The CobraPLUS™ (Fig. 1) is a new second generation version of the CobraPLA™ extraglottic (supraglottic) airway device. It is similar to the original CobraPLA™ in that it has a distal “Cobra head” which serves to stent soft tissues away from the laryngeal inlet and a circumferential cuff located cephalad to the head that enables airway sealing and delivering of positive pressure ventilation. Moreover, the CobraPLUS™ provides three new added features. First, the distal end of the breathing tube (originally straight in the CobraPLA™) has been curved. This makes insertion and positioning in the airway even easier than before, as the device conforms to the anatomy in which it resides. In our preliminary study [10] in infants and children, the CobraPLA™ had a significantly greater airway sealing pressure at 60 cmH_2O cuff inflation pressure, greater peak airway pressure obtained before cuff leakage (20 ± 6 vs. 17 ± 5 $\text{cm H}_2\text{O}$), and significantly lower gastric gas volumes (9 ± 8 vs. 18 ± 16 ml) when compared to the LMA. In addition, the fiberoptic view through the device was superior with the CobraPLA™ both after induction of anaesthesia as well as prior to emergence. Moreover, there was a significant change in the fiberoptic view in the LMA group but not in the CobraPLA™ group during the course of surgery indicating that CobraPLA™ might be more stable in the airway. Because of these performance characteristics and the easy insertion as well as our clinical experience with using the new CobraPLUS™ we chose to use it in our patient.

The second new design feature which influenced our choice is the fact that the device has a temperature probe attached to the lateral posterior part of the cuff permitting core temperature measurement. Wadhwa and colleagues' [11] demonstrated that temperatures recorded from the lateral-

posterior cuff were identical to tympanic membrane temperatures, with 97% of the values differing by less than 0.58oC. The addition of a temperature probe is very practical since most of the practitioners will use a skin temperature probe during cases managed with a supraglottic device. The lack of accuracy of the skin temperature probe is well recognized.

The third new advantageous design feature of the CobraPLUS™ is the fact that it has a CO₂ sampling line opening at the distal “Cobra head” of the device for the paediatric sizes (sizes 1/2, 1, and 1 1/2). The distal placement of the sampling port allows for measurement of the ETCO₂ just in front of the vocal cords, thus decreasing both the effects of dead space and the possible leak effect. Distal ETCO₂ measurements have been found to be different from the conventional measurements both when measured with an ETT [12] or with the CobraPLA™ [13] at the Y-piece of an anaesthesia circuit, with the distal values more closely approximating arterial carbon dioxide tensions. In the CobraPLUS™ version of the CobraPLA™ distal measurements were found to be about 8 mmHg greater than conventional Y-piece measurements.

In conclusion, we present a case of a 6 month old, ex premature patient with tracheomalacia and history of difficult weaning from mechanical ventilation after repeated surgeries under general anaesthesia. For the current procedure he was successfully managed using a size 1/2 Cobra PLUS™ extraglottic airway. This is the first report of using this device in a patient.

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