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Case Report

A rare and challenging case of anaesthetic management of paediatric laryngo-tracheo-broncho-malacia for supraglottoplasty

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ABSTRACT

Paediatric laryngotracheobronchomalacia is a rare and extremely challenging scenario with risk of complete airway collapse under general anaesthesia. Laryngomalacia causes collapse of the supralaryngeal structures during inspiration as it is associated with short aryepiglottic folds, redundant arytenoid mucosa prolapsing into the glottis and a long curled epiglottis. Tracheomalacia and tracheo-bronchomalacia are characterized by abnormally compliant trachea and major bronchi. Most of the general anaesthetic agents decreases the airway tone and may predispose these patients to unremmitable airway obstruction under anaesthesia. We report successful anaesthetic management of one-year-old child with laryngotracheobronhcomalacia posted for supraglotoplasty. This needs a profound understanding of the pathophysiology of the complex airway condition and the effects of various anaesthetic agents on airway.

Keywords: Pediatric, Laryngotraceobronchomalacia, Airway collapse, Airway tone

INTRODUCTION

The incidence of laryngomalacia is 1 in 2100-2600 and 2-48% of these are associated with tracheomalacia or bronchomalacia.[1] Laryngomalacia causes collapse of the supralaryngeal structures during inspiration as it is associated with short aryepiglottic folds, redundant arytenoid mucosa prolapsing into the glottis and a long curled epiglottis. Tracheomalacia and tracheo-bronchomalacia (TBM) are characterized by abnormally compliant trachea and major bronchi. Primary TBM is due to impaired cartilage integrity or due to disproportionate laxity of the posterior wall (pars membranacea) and is frequently associated with comorbidities, such as craniofacial abnormalities, tracheo-oesophageal fistula, etc. Secondary TBM is due to external impingement of trachea caused by adjacent intra-thoracic structures that can lead to exaggerated collapse and obstruction with expiration.[2]

We report a very rare case of anaesthetic management of a child with laryngo-tracheo-bronchomalacia posted for supraglottoplasty.

CASE REPORT

One-year-old male child weighing 10 kg with history of on and off cough and noisy breathing since age of 7 months. Noisy breathing aggravated on supine position and relieved in prone position, and associated with cyanosis during severe episodes of excessive coughing. There was history of multiple episodes of hospitalization for respiratory distress, which was treated by salbutamol nebulization and antibiotics, last admission was 10 days back.

Birth history was full term normal vaginal delivery, with no history of neonatal ICU stay, cyanosis or seizures. His development history was normal.

Echocardiography revealed normal intracardiac physiology. Barium swallow showed no gastroesophageal reflux. There was diffuse ground glass haze involving bilateral lung fields, subpleural fibrosis seen along posterior basal segment of right upper lobe and atelactic band seen involving right middle lobe in computed tomography (CT) scan.

Videobronchoscopy showed laryngomalacia with moderate tracheomalacia in intrathoracic part extending to right main bronchus with tracheobronchitis (Figure 1).

Patient was posted for supraglottoplasty for recurrent life-threatening episodes of lower respiratory tract infection.

On examination patient was sitting comfortably, chest was bilateral clear, there was no stridor, no chest retractions, heart rate 110/min, with good intravenous access.

High risk informed parental consent taken. On the day of surgery child was nebulized with salbutamol and intravenous cannula secured in parental presence.

Inside the operation theatre paediatric difficult airway cart with all adjuncts and alternatives to laryngoscopy and supraglottic airway devices was kept ready. Routine monitors like electrocardiography, non-invasive blood pressure and pulse oximetry applied. Injection hydrocortisone 20 mg and glycopyrrolate 100 mcg intravenously (IV) were given before induction. Intravenous induction done with graded doses of ketamine in 10+10 mg and assisted positive pressure manual mask ventilation done with 100% oxygen and gradually increasing concentration of sevoflurane (2-4%). Ventilation was confirmed with end-tidal CO_2 and chest rise, check laryngoscopy was done with C-Mac Laryngoscope (Karl Storz, Tuttlingen, Germany) with miller straight blade number 1 and a long floppy epiglottis was visible (Figure 2).

Two puffs of 10% lignocaine spray was done inside and around the glottis. Again assisted mask ventilation done and ketamine in bolus dose of 5+5 mg IV given, laryngoscopy attempted with optimal external laryngeal manipulation (OELM) and trachea intubated with size 3.5 cuffed oral endotracheal tube and fixed at 12 cm and bilateral air entry confirmed.

Maintenance of anaesthesia was done with oxygen, air and sevofluane, IV fentanyl 10+10 mcg and 5 mg atracurium given once it was confirmed that patient can be ventilated on volume control ventilation with tidal volume 90 ml, respiratory rate 14/minute PEEP 3 and peak airway pressure were between 19-21 cm H_2O. Intraoperative course remained uneventful and child was not reversed and shifted to pediatric ICU for elective ventilation and weaned off gradually from the ventilator after 2 days.

Later on during follow up it was observed that episodes of respiratory tract infection have decreased considerably and associated with wheeze and slight tachypnoea only without any cyanosis. Now child can be treated at home with nebulizations and does not need antibiotics and hospital admission.

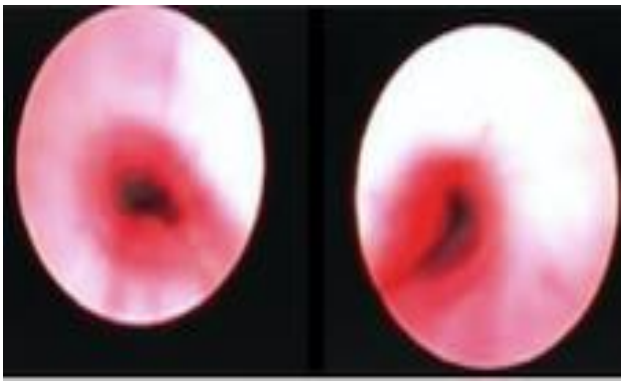

Figure 1: Moderate tracheomalacia in intra-thoracic part seen during videobronchoscopy.

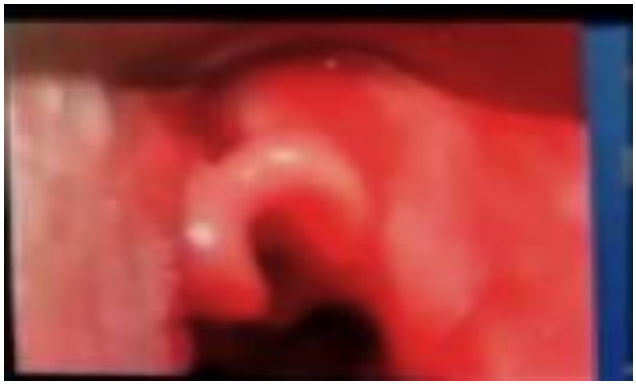

Figure 2: Long floppy epiglottis.

DISCUSSION

This is a very rare and challenging case of successful anaesthetic management of laryngotracheo-bronchomalacia. The literature on anaesthetic management of laryngomalacia and tracheoebronchomalacia is available separately but anaesthetic management of this complex clinical condition with a high risk of airway collapse under general anaesthesia is very sparse.

Inhalational induction with sevoflurane reportedly causes airway more collapsible in case of tracheomalacia because of its bronchodilator effect, but has been successfully used in induction of laryngomalacia.[3] Isoflurane and enflurane may also decrease airway tone, isoflurane causes decreased muscle activity especially soft palate and aggravate collapsibility of the upper airway.[4] We planned intravenous induction and premedication was done with glycopyrrolate to decrease secretion and hydrocortisone to prevent airway edema on repeated manipulations and its bronchodilator effect. Titrated dose of ketamine was used as it maintains tone of airway and has been used

successfully in cases of both laryngomalacia and tracheobrochomalacia. Graded concentration of sevoflurane was used as induction with inhalational agents should not be rapid as laryngomalacia is unmasked.

Propofol may worsen collapsibility of the upper airway as a result of depression of central respiratory output to upper airway dilator muscles and of upper airway reflexes.[5] Zaben et al used dexmedetomidine propofol combination with spontaneous ventilation in a 3-year-old child suffering from laryngotracheomalacia for retrieval of foreign body bronchus. Ketamine and propofol combination has been used successfully in patients with laryngomalacia and tracheomalacia.[6]

In case of laryngomalacia to prevent fatal airway obstruction chin lift, jaw thrust, and gentle mask ventilation avoiding high inspiratory pressure is advisable with adequate sedation, but oropharyngeal airway should be avoided as it may further displace the prolapsing epiglottis.[7]

During spontaneous breathing intrapleural pressure is slightly more subatmospheric than the intratracheal pressure and thus the airway is held open. But during forced expiration (such as coughing or in the patient who needs to overcome the increased airway resistance at a lower trachea e.g. trachea-bronchomalacia) both intra-pleural pressure and alveolar pressure markedly increase and may lead to tracheal compression which may become evident in patients with TBM under GA with spontaneous ventilation. Muscle relaxants may reduce the increase of intrat-horacic pressure due to intercostal and abdominal muscle contraction and thus may help in relieving obstruction with positive pressure ventilation. Muscle relaxants like succinylcholine vecuronium, rocuronium and atracurium has been used in patients with laryngomalacia and tracheomalacia and have shown to improve airway obstruction.[8]

Continuous positive airway pressure with or without intermittent positive pressure ventilation reduces the gradient between the intra-thoracic and intratracheal pressures during forced expiration; hence tracheal collapse is less likely to occur during controlled ventilation than during spontaneous breathing. We assisted with manual positive pressure ventilation at time of induction and gave relaxant once trachea was intubated. Okuda et al reported relief of airway obstruction occurred during spontaneous breathing by initiating controlled ventilation after injection of a muscle relaxant.[9]

While extubation as the patient starts breathing spontaneously, airway collapse occurs because the positive airway pressure, which acts as a splint to open the airway, is withdrawn. Trachea should be left intubated and patient should be extubated once intrapleural–intratracheal pressure relationship has normalized.

We kept our patient intubated as a part of surgical protocol for patients with airway malacia and patient was successfully weaned off from ventilator after 2 days.

CONCLUSION

Laryngo-tracheo-broncomalacia is a rare life threatening condition prone for complete airway collapse under anaesthesia. A careful anesthesia technique in consultation with ENT surgeons should be planned with a postoperative intensive care monitoring.

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