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Utility Of Fogarty Catheter As Bronchial Blocker In Achieving One-Lung Ventilation: A Case Report

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ABSTRACT

One lung ventilation (OLV) is an important procedure in pediatric anesthesia for thoracic surgery requiring lung isolation to enhance surgical visibility and prevent contamination of the healthy lung. In adults, double lumen tube (DLT) is the gold standard in OLV technique. Management of OLV in pediatric is still a challenge due to limitations in using small-sized DLT. As an alternative device, bronchial blockers was chosen to isolate non-dependent lung. Anesthesia management considered the risk of hypoxemia and ventilation-perfusion (V/Q) mismatch during lateral decubitus position. Close intraoperative monitoring of oxygenation and respiration ensured optimal outcomes without serious complications. This article reports an 8-year-old boy with a mediastinal mass undergoing Video Assisted Thoracoscopic Surgery (VATS). One lung ventilation technique were performed using a Fogarty catheter guided by fiber optic laryngoscopy (FOL).

KEYWORDS: anesthesia, bronchial blocker, Fogarty catheter, one lung ventilation, pediatric.

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INTRODUCTION

Children are more prone than adults to develop hypoxia. It because of their smaller body size and consume more oxygen per kg of body weight.[1] Maintenance of one-lung ventilation while performing thoracic surgery is more difficult in children than adults.[2] In thoracic surgery requiring optimal intrathoracic visualization, one-lung ventilation (OLV) is achieved by collapsing one lung. In adults, the double-lumen tube (DLT) remains the gold standard for OLV.[3] One lung ventilation in pediatric patient presents significant challenges due to limited availability of small-sized DLT, necessitating alternative lung isolation techniques. Bronchial blockers (BB) or conventional single-lumen endotracheal tubes are commonly employed, though these methods may result in incomplete lung collapse, recurrent re-expansion, frequent device dislodgement, and greater reliance on fiber-optic laryngoscopy (FOL) to verify BB position.[4] In this case report, we describe the usage of a Fogarty catheter as a bronchial blocker to collapse one lung and facilitate surgical visualization.

CASE REPORT

An 8-year-old boy, body weight 23,6 kg, height 132 cm, presented with dyspnea since two months. This patient had a history of lung tuberculosis and completed 6 months of antituberculosis drugs without symptoms. Chest X-ray showed opacity mass with measure of 5.9 x 7.3 cm, as height as left sided of thoracal vertebrae 3-7 with impel the left bronchus to superior, suspect a mediastinal mass. Then, Chest Computed Tomography (CT) Scan revealed a cystic mediastinal mass measuring approximately 3.2 × 4.8 × 8.8 cm, compressing the tracheal lumen and left main bronchus, adhere with clear border and shove trachea and cardiac to anterior, adhere with clear border and shove esophagus to the right side.

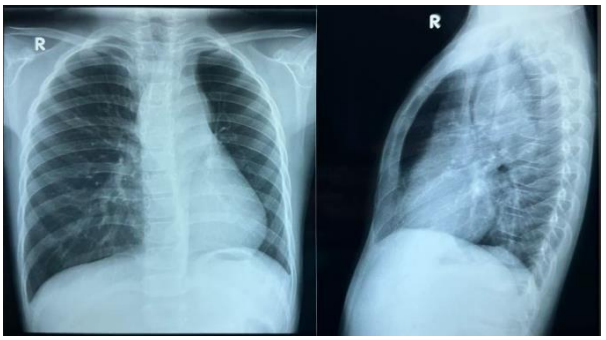


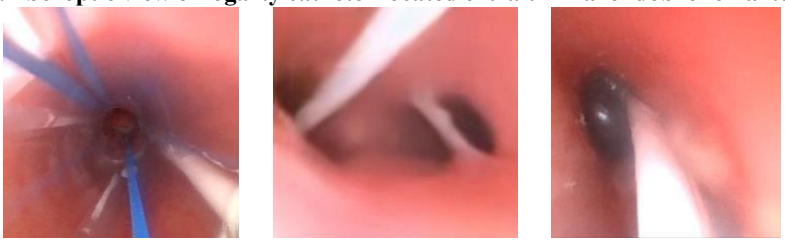
Figure 1. Posteroanterior and lateral view of chest x-ray.

Figure 2. Chest Computed Tomography (CT) Scan of the patient.

He entered the anesthesia waiting room with his guardian, and he was moved to the operating room after intravenous sedation using 2 mg of midazolam. Noninvasive blood pressure monitoring equipment, electrocardiography, and pulse oximetry were used to monitor his vital signs, and anesthesia was induced without complications.

A neuromuscular block was performed using intravenous injection of 20 mg of rocuronium, and tracheal intubation was attempted. An attempt was made to place 5Fr fogarty catheter, followed by a 5.5-mm regular endotracheal tube into the trachea using a curved direct #2 macintosh laryngoscope blade. Then, we used 4.5-mm-diameter flexible bronchoscope intraluminal to guide the Fogarty catheter to the right bronchus. After ensuring that it had passed through the right bronchus (Figure 3), Fogarty cuff was inflated and the the auscultation of lung sounds were absent in the right lung field. After auscultation to confirm that, the blocker was fixed. Anesthesia was maintained using 2.5–3.0 vol% sevoflurane, 1.0 L/min of oxygen, and 2.0 L/min of air. The patient was switched to the left lateral decubitus position for video-assisted thoracoscopic surgery. Intraoperatively, lung isolation was maintained effectively, and the procedure proceeded without complications. After the surgery, 0.25 mg of atropin sulfate and 1.0 mg of pyridostigmine were administered to reverse the neuromuscular block. After monitoring the patient for about 2 hours in the recovery room, patient condition was stable and transferred to the general ward.

Figure 3. fiberoptic view of fogarty catheter located extraluminal endobronchial tube (a), fogarty catheter has



introduced in right bronchus (b), and inflated cuff isolate the left lung (c).

DISCUSSION

One lung ventilation (OLV) in pediatric patients represents a significant anesthetic challenge due to the unique anatomical and physiological characteristics of this population. They have smaller functional residual capacity (FRC) and higher metabolic oxygen demand compared to adults. These factors contribute to a rapid decline in oxygenation when the non-dependent lung is excluded from ventilation during OLV.[5] Hypoxic pulmonary vasoconstriction (HPV) is a vital compensatory mechanism that redirects blood flow from the non-ventilated, hypoxic lung to the well-ventilated lung, thereby minimizing ventilation-perfusion (V/Q) mismatch. However, in infants and young children, this HPV response is often immature or less effective, increasing the likelihood of intraoperative hypoxemia. The compliant chest wall and nearly symmetrical pulmonary blood flow distribution in pediatrics further complicate the gravitational redistribution of blood flow during lateral positioning, limiting the improvement of oxygenation seen in adults.[5-7]

To optimize gas exchange during pediatric OLV, careful ventilation management is essential. Strategies include the use of low tidal volumes and appropriate levels of positive end-expiratory pressure (PEEP) to maintain alveolar recruitment in the dependent lung and prevent atelectasis. Additionally, vigilant monitoring of oxygen saturation and end-tidal carbon dioxide allows for timely detection of hypoxia and hypercapnia. Anesthetic agents must be chosen to preserve HPV, as volatile anesthetics can attenuate this response, worsening V/Q mismatch.[6-7] The lateral decubitus positioning during thoracic surgery exacerbates ventilation-perfusion mismatch due to gravitational effects on pulmonary blood flow. Anesthetic management, therefore, must optimize oxygen delivery and ventilation parameters meticulously. In this case, sevoflurane inhalation anesthesia combined with oxygen and air proved effective, maintaining the child's oxygen saturation near 100% throughout the operation. The use of neuromuscular blockers was carefully titrated and reversed promptly to reduce postoperative respiratory complications, underscoring the delicate balance required in pediatric anesthesia.[5-6]

Unlike adults, pediatric patients often lack appropriately sized double lumen tubes (DLTs), necessitating the use of alternative lung isolation devices such as bronchial blockers. Among these, the Fogarty catheter has demonstrated efficacy as a bronchial blocker, providing adequate lung isolation in children undergoing thoracic surgery.[3]

This case report presents the successful application of a Fogarty catheter as a bronchial blocker for achieving one lung ventilation (OLV) in an 8-year-old pediatric patient undergoing video-assisted thoracoscopic surgery (VATS) for a mediastinal mass. The

patient's mediastinal mass compressed the tracheal lumen and left main bronchus, complicating airway management and necessitating precise lung isolation to prevent contamination and optimize the surgical field. Placement of the 5Fr Fogarty catheter was accomplished under direct visualization using a 4.5-mm flexible fiber-optic bronchoscope, ensuring accurate positioning within the right upper lobe bronchus. This technique corroborates current pediatric anesthetic practices, which emphasize fiber-optic guidance to reduce risks of malposition and lung isolation failure.[3,6]

Intraoperative management preserved adequate oxygenation and ventilation despite the lateral decubitus positioning and potential V/Q mismatch. Maintenance anesthesia with sevoflurane combined with oxygen and air provided sufficient respiratory stability, while neuromuscular blockade reversal was safely achieved post-procedure, reflecting the efficacy of contemporary anesthetic protocols for pediatric thoracic surgery.[2] The report highlights essential considerations specific to pediatric OLV, including the inability to suction secretions past the inflated cuff of the Fogarty catheter and the reliance on absorption atelectasis aided by manual lung deflation by the surgeon. These challenges underline the importance of collaboration between anesthesiology and surgical teams to optimize lung collapse and reduce perioperative complications.[4]

Bronchial blockers are a preferred lung isolation technique in pediatrics, with available options including endobronchial intubation, Univent tubes, Fogarty catheters, and Arndt blockers.[3] We utilized an extraluminal Fogarty catheter in this cases. While intraluminal insertion is possible, extraluminal placement is more common, as it obviates the need for a three-way connector and preserves the ETT lumen. However, extraluminal insertion must be performed prior to intubation and carries a risk of desaturation if prolonged.[9,10]

The extraluminal technique allowed preservation of the endotracheal tube lumen and avoided the need for adjunct devices such as three-way connectors, reducing airway resistance and potential ventilation complications. However, this approach necessitates swift and skilled placement to avoid hypoxemia during catheter insertion — a risk mitigated by meticulous preoperative planning and fiber-optic confirmation.[6,8] The Fogarty catheter's high-pressure balloon demands careful inflation monitoring to prevent bronchial trauma, consistent with recent case series advocating for cautious balloon volume titration to balance effective lung isolation with airway safety.[3] The Fogarty catheter provides adequate lung isolation but does not permit suctioning when the balloon is inflated.[6] Lung collapse is often incomplete and occurs via absorption atelectasis rather than direct evacuation.[1] Surgeons must assist in lung deflation manually before careful balloon inflation. Fogarty balloons are high-pressure devices and risk bronchial rupture if overinflated.[3,10] Routine use of FOL is recommended to confirm catheter position and optimize balloon volume.[6]

CONCLUSION

Fogarty catheters can serve as effective bronchial blockers for pediatric OLV. Routine fiber-optic laryngoscopy is advised to confirm catheter placement and minimize OLV failure.

Conflict of Interest

The authors declare there is no conflict of interest.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. Patients have given their consent for their clinical information to be reported in the journal.

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