

CASE REPORTS

Prolonged Paediatric Foreign Body Extraction: Challenges Bring Out Innovations

Uma Hariharan¹, Shreyash Agrawal²**HOW TO CITE THIS ARTICLE:**

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ABSTRACT

Airway foreign bodies can be challenging for both the anesthesiologist and the surgeon, especially in children. Deep-seated foreign body extraction can be prolonged and difficult, requiring a still and bloodless field, in addition to concerns such as shared airway, ensuring adequate oxygenation and ventilation, and prevention of airway trauma. The perioperative management of pediatric airway foreign body can be mired by hypoxia, hypercarbia, foreign body dislodgements, barotrauma and airway trauma. We hereby present an interesting and novel method of administering jet ventilation to a child undergoing prolonged airway foreign body extraction by using an innovative airway connector adjunct for intermittent ventilation through the circuit connected to the jet ventilator-bronchoscope assembly with the adapter of airway exchange catheter.

KEYWORDS

- Airway Foreign Body • Bronchoscopy • Pediatric Anaesthesia • Innovation
- Jet Ventilation • Mapleson F Circuit • Cooks Airway Exchange Catheter.

INTRODUCTION

Pediatric foreign body extraction can be challenging and can cause hypoxia, hypercarbia or trauma, if prolonged and difficult. Jet ventilation can lead to dislodgement of deep-seated foreign bodies. We hereby describe

an innovative method of using Jet Ventilator - Mapleson F Circuit-Airway Connector Adjunct Assembly for extraction of difficult airway foreign body in a 14-month old child presenting with respiratory distress under general anaesthesia.

AUTHOR'S AFFILIATION:

¹ Professor, Department of Critical Care Medicine, Atal Bihari Vajpayee Institute of Medical Sciences and Dr. RML Hospital, New Delhi, India.

² Senior Resident, Department of Anaesthesia, Goyal Hospital & Urology Centre, New Delhi, India.

CORRESPONDING AUTHOR:

Uma Hariharan, Professor, Department of Critical Care Medicine, Atal Bihari Vajpayee Institute of Medical Sciences and Dr. RML Hospital, New Delhi, India.

E-mail: uma1708@gmail.com

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CASE REPORT

A 14-month-old child presented to the emergency room with progressive breathlessness and dyspnea over 24 hours. On examination, the child was tachycardic and pulse oximetry (SpO₂) was 98-100% on a facemask with 3 l/min oxygen. A chest X-ray was done which reported no significant abnormalities. The Otorhinolaryngologist team was consulted and the possibility of an endobronchial foreign body was considered after a detailed history was obtained from the parents and it was found that the child was playing with some toys after which the distress started. The child was planned to be taken to the emergency operation theatre (OT) for a rigid bronchoscopy under general anaesthesia. Parents were informed about the procedure and written informed consent was taken. On reaching the OT, the child was pre-oxygenated to maintain 100% SpO₂. Arterial blood gas analysis was within normal limits. Standard monitoring was started with pulse oximetry, 3-lead ECG, non-invasive blood pressure, bispectral index (BIS), and axillary temperature. A rapid sequence induction with endotracheal intubation was done and ventilation was continued with 100% oxygen. The otorhinolaryngologist then took over, the endotracheal tube was removed and a rigid bronchoscope was introduced. The ENT surgeon did a quick scanning and nothing was found in the immediate visual field. Considering the possibility of a prolonged procedure duration and possible endobronchial foreign body, an innovative technique was established to provide oxygenation and ventilation to the child.

A Cook's airway exchange catheter was taken and the adapter (**Figure 1**) was separated, this was then attached to the Manujet Ventilator through the luer-lock system. The manujet ventilator was then connected to a Mapleson-F / Jackson - Rees modification of Ayre's T-piece using this connector in between (**Figure 2**). Using the universal 22/15mm connector on the Mapleson circuit, the Jet ventilator - innovative connector assembly was connected to the ventilating port of the Storz Rigid Bronchoscope (**Figure 3**). The jet ventilator was activated for 1 second, the circuit and reservoir bag were filled. Intermittent assisted ventilation was continued with the reservoir bag at a rate of 18-20 breaths/minute with adequate tidal volumes. A driving pressure of 25-30 psi was used and the procedure took a total duration

of 60 minutes. The child was hand ventilated to ensure adequate compliance with an FiO₂ of 0.6. A plastic toy piece (**Figure 4**) of 10*5*5 mm was retrieved from the right main bronchus. The Jet Ventilator - Mapleson F Circuit- Airway Connector Adjunct Assembly (**Figure 5**) was used effectively for difficult foreign body extraction. The child was reversed from anesthesia and kept in the post-anesthesia care unit for 6-8 hours for diligent monitoring. The child was transferred out and discharged later after uneventful course in the ward. The child was followed up for one month to look for any complications.



Figure 1: Cooks Airway Connector Device



Figure 2: Manujet Ventilator with Luer Lock System

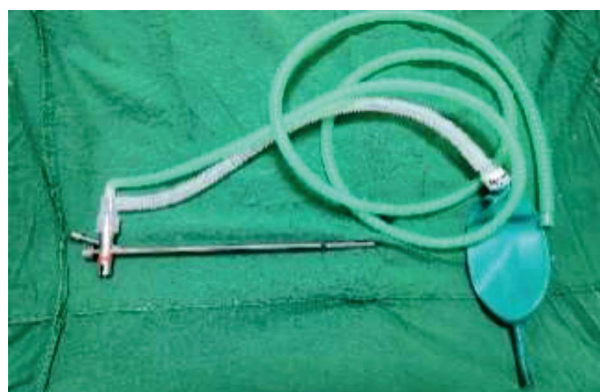


Figure 3: Mapleson F Circuit connected to Rigid Bronchoscope



Figure 4: Plastic Foreign Body Retrieved



Figure 5: Jet Ventilator - Mapleson Circuit- Adjunct Assembly

The following are the likely problems which can be encountered during difficult foreign body extractions:

1. Risk of foreign body dislodgement at high turbulent flows received from anesthesia workstation.
2. Risk of rapid desaturation with reduced apnea times in pediatric population.
3. Shared airway with the otorhinolaryngologist.
4. Difficulty in locating and extracting the foreign body.

DISCUSSION

Managing airway foreign body is challenging due to multiple reasons. There is a higher susceptibility of the pediatric population toward hypoxia, especially during prolonged airway procedures. Jet ventilation alone can not suffice, especially in prolonged-duration procedures, in view of CO₂ build-up risk.

Table 1: Anaesthesia Challenges and possible solutions

*Shared airway *Prevent Barotrauma	*Good communication with the surgery team
• Ensure adequate oxygenation and ventilation. • Prevent dislodgement of foreign body further down the bronchus • Provide enough time for the surgeons to successfully retrieve the foreign body. • Prevent airway complications including dislodgement of foreign body, trauma to airway, loss of airway.	• Minimal Inflation pressures to be used • Gentle airway manipulations. • Careful hand ventilation during critical times. • Adequate use of sedation and muscle relaxants with control of airway. • Avoid high-flow, high-pressure for prolonged periods

Positive pressure ventilation using a Mapleson - F (Jackson-rees modification) circuit connected to an anaesthesia machine risks dislodgement of the foreign body as well as disruption of the surgical field due to the high turbulent fresh gas flows. Manual intermittent positive pressure ventilation was maintained with a jet ventilator - adjunct assembly. This innovative adjunct assembly was advocated to help maintain adequate ventilation. It also prevented dislodging the foreign body further down the bronchus.

CONCLUSION

We describe a novel modification using an innovative connector for a difficult, pediatric,

left bronchus airway foreign body extraction using a jet ventilator without causing hypoxia. The use of the Jet Ventilator - Adjunct Assembly with the Cook's airway connector with the Mapleson - F circuit brings into light the possibility of safely extending the procedure duration in difficult situations, preventing the risks. It can also be a useful tool in resource-limited settings for oxygenation & ventilation in pediatric patients, especially outside the operation theatre. Positive pressure ventilation using a Mapleson - F (Jackson-rees modification) circuit connected to an anesthesia machine risks dislodgement of the foreign body as well as disruption of the surgical field due to the high turbulent fresh

gas flows, which was effectively prevented by this innovative assembly.

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