Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol.14 , Issue 10s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

The Trapped Airway: A Case Of Retained Foreign Body In The Right Main Bronchus—Challenges In Anaesthesia And Airway Management.

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Cite this paper as: Dr. Shama Veeranna Bevinagidad , Dr. Mahantesh S. Mudakangoudar (2025) The Trapped Airway: A Case Of Retained Foreign Body In The Right Main Bronchus—Challenges In Anaesthesia And Airway Management.... Journal of Neonatal Surgery, 14, (10s) 1182-1186

ABSTRACT

INTRODUCTION: Foreign body aspiration is a significant cause of morbidity and mortality in children and presents distinct challenges for the anaesthesiologist. When a foreign body remains undiagnosed or retained for a prolonged period, it can persist for years, resulting in chronic airway inflammation, recurrent infections, airway oedema, fibrosis, and progressive respiratory compromise. These long-standing pathological changes complicate diagnosis, increase anaesthetic risk, and frequently necessitate advanced airway strategies and coordinated multidisciplinary management.

CASE REPORT: We report the case of a 9-year-old female with a five-year history of recurrent cough and morning breathlessness following foreign body aspiration. The patient had undergone multiple prior airway evaluations and repeated intubations, resulting in a potentially difficult and edematous airway. Anaesthetic management required meticulous airway planning and precise lung isolation. Fibreoptic guided left endobronchial intubation was performed to maintain ventilation and facilitate right thoracotomy for surgical retrieval of the foreign body. Thoracic epidural analgesia was secured for perioperative and postoperative pain control.

DISCUSSION: Foreign body aspiration is frequently misdiagnosed, and delayed management—particularly in long-standing cases—can lead to severe airway distortion and complications that significantly impact anaesthetic safety. Thorough preoperative evaluation, anticipation of a difficult airway, invasive monitoring, and close coordination with surgical teams are essential for successful outcomes.

CONCLUSION: Foreign body aspiration is common in childhood and mandates early recognition and intervention. Prolonged retention can lead to serious or potentially fatal complications, emphasizing the importance of timely diagnosis and multidisciplinary management

INTRODUCTION

Managing a paediatric patient with tracheobronchial foreign body aspiration (FBA) presents unique challenges, particularly when the foreign body has been retained for a prolonged duration. Chronic retention leads to persistent airway inflammation, mucosal edema, granulation tissue formation, and distortion of normal airway anatomy, all of which complicate airway management and increase perioperative risk.

While the incidence of FBA is highest in children under five years of age, delayed diagnosis may result in patients presenting years later with chronic respiratory symptoms. Anaesthetic induction in such cases must be approached with extreme caution. Careful titration of anaesthetic agents is essential to avoid hypoxia, airway collapse, or dislodgement of the foreign body. Balanced anaesthesia using agents such as propofol or volatile anaesthetics, combined with neuromuscular blockade, facilitates controlled airway access...

In cases where bronchoscopic removal fails or the foreign body is deeply impacted, thoracotomy may be required. These scenarios demand advanced airway strategies, invasive monitoring, and meticulous perioperative ventilation management.

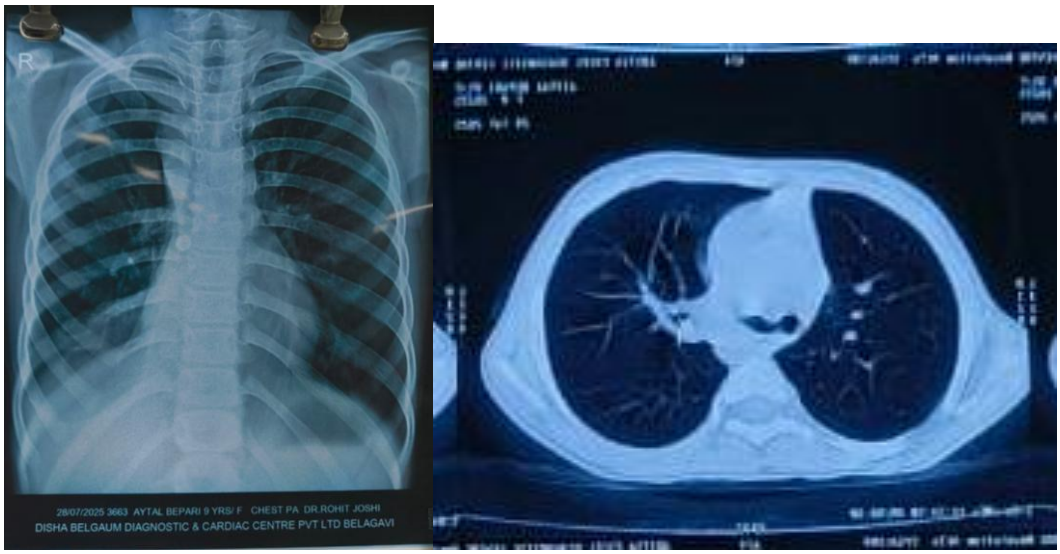
Overall, the anaesthesia team role is critical in maintaining adequate oxygenation and ventilation while enabling the safe removal of the foreign body, with constant monitoring to avoid potential complications such as bronchial injury, aspiration pneumonia, or recurrent airway obstruction

CASE REPORT

A 9-year-old girl weighing 28 kg presented with a five-year history of recurrent cough and early-morning breathlessness following an episode of foreign body aspiration. At four years of age, she accidentally aspirated a rubber foreign body of unknown origin. Since then, she had persistent respiratory symptoms and had undergone multiple prior airway evaluations and manipulations at other centres, raising concern for airway oedema and distortion. Worsening of symptoms prompted consultation in our institute.

On examination, the patient had a normal body mass index. Vital signs were stable with a temperature of 37.2°C, blood pressure of 100/60 mmHg, pulse rate of 98 bpm, respiratory rate of 18/min, and SpO_2 of 100% on room air. Reduced air entry was noted on the right side. Laboratory investigations were within normal limits.

Chest X-ray and computed tomography (CT) revealed retained foreign body in the right main bronchus.



Intravenous (I.V.) access was established on the left hand with a 22 G I.V. cannula. The child was pre-medicated with IV Glycopyrrolate 0.005 mg/kg and IV Ketamine 2mg/kg and anaesthesia was induced with IV Midazolam 0.05mg/kg, IV Fentanyl 2µg/kg and IV Propofol 2 mg/kg. After confirming mask ventilation, IV Atracurium 0.5 mg/kg was given. Fibreoptic bronchoscopy revealed complete visual obscuration of the right main bronchus with a dark, non-visualised lumen, precluding identification of airway anatomy or foreign body. This confirmed complete obstruction of the right bronchus and guided the decision for left endobronchial intubation to ensure effective ventilation and surgical access. Fibreoptic-guided intubation was performed successfully using a 5.5-mm ID endotracheal tube. ET tube was advanced further into left bronchus, and the cuff was inflated. Auscultation of the chest elicited absence of air entry on Left side. Patient was ventilated on pressure control mode in closed circuit and maintained with Air: O2 (50:50) with Isoflurane (Et Isoflurane between 0.6-1.0). Normocapnia was maintained with suitable ventilator frequency and tidal volume. Intraoperative analgesia was maintained with IV Fentanyl and muscle relaxation maintained with IV Atracurium. Patient was given left lateral position.

Regional Analgesia: Thoracic epidural is inserted at the T6-T7 interspace corresponding to the surgical dermatomes: T5–T7. After identifying the epidural space, 2–3 cm of catheter is advanced into the epidural space. A small slack loop is created at the insertion site to prevent tension during movement. It is secured using sterile adhesive strips and covered with a transparent occlusive dressing. The catheter is routed and fixed over the shoulder or lateral chest wall, away from the surgical incision, drains, and pressure points. 3 ml of 0.0625% Inj Bupivacaine was injected.

Intraoperative monitoring included Heart rate, oxygen saturation, end-tidal carbon dioxide (EtCO2) and electrocardiography (ECG) with ST segment analysis. Invasive arterial blood pressure monitoring was instituted via left radial arterial cannulation to allow beat to beat haemodynamic monitoring and frequent arterial blood gas analysis, given the anticipated prolonged surgery and one-lung ventilation.

Right posterolateral thoracotomy was performed. Surgery lasted for two and a half hours. Right bronchus was opened and foreign body was removed. Upon completion of bronchial closure, ET tube was withdrawn in the trachea and both lungs were ventilated. Following bronchial closure, a Valsalva manoeuvre was performed to a sustained airway pressure of 30–40 cm H_2O to assess the integrity of the repair, and no air leak was detected**.**

Blood loss was 350cc and Urine output was > 1 ml/kg/hour during surgery. Ringer's lactate was used as maintenance and replacement fluid intraoperatively. One unit of packed red blood cells (PRBC) was transfused intraoperatively.

Photo shoeing dense adhesions and plastered Lung

Photo showing the bronchotomy with foreign body

The patient was reversed and extubated after surgery. She remained haemodynamically stable throughout the procedure.

DISCUSSION:

Foreign Body Aspiration (FBA) is a critical condition in paediatric patients, most commonly affecting those under the age of 5. This is due to their oral exploratory behaviours and underdeveloped protective airway reflexes. The incidence of FBA is highest in children aged 1 to 3 years, who often place objects in their mouths as part of normal developmental behaviour. Rigid bronchoscopy remains the gold standard for removal, although flexible bronchoscopy is increasingly used. In rare cases, where foreign bodies are deeply impacted or inaccessible via bronchoscopy, more invasive procedures like thoracotomy or bronchotomy may be necessary. From an anaesthesia perspective, effective airway management and ventilation are key components of ensuring patient safety during the procedure.

Airway Management in Paediatric FBA: Key Considerations

In paediatric FBA procedures, the main goal is to provide safe airway management for rigid bronchoscopy or thoracotomy in children requiring careful planning due to their smaller airway size and the dynamic nature of their respiratory systems.

One-Lung Ventilation (OLV):

One-lung ventilation (OLV) is often used to facilitate surgical exposure during thoracotomy or bronchotomy. OLV helps collapse the lung on the operative side, providing better surgical access. The use of OLV in children can be technically challenging but is necessary in complex cases where lung isolation is critical for a successful surgical outcome.

Anaesthetic management during OLV involves ensuring that oxygenation is maintained despite the collapse of one lung. During OLV, continuous monitoring of oxygen saturation is essential.

Anaesthetic Techniques for Thoracotomy in FBA Surgery

Thoracic epidural analgesia

Thoracic epidural analgesia is an essential component of anaesthesia management in these procedures. It provided effective perioperative and postoperative pain control, facilitating smooth on-table extubation. In the postoperative period, it ensured continuous, segmental analgesia with reduced reliance on systemic opioids, thereby minimizing opioid-related adverse effects. Adequate analgesia promoted effective coughing, deep breathing, and early mobilization, resulting in improved pulmonary mechanics and a lower incidence of respiratory complications. Additionally, thoracic epidural analgesia attenuates the surgical stress response and surgery-induced immune alterations, contributing to enhanced postoperative recovery and improved overall outcomes in patients undergoing thoracotomy.

Anaesthesia Challenges and Potential Complications

Anaesthesia for paediatric FBA procedures, especially in complex cases, carries specific risks. The management of the paediatric airway presents unique challenges that require close monitoring and skilful techniques:

Airway Obstruction and Desaturation:

Obstruction or displacement of the foreign body during the procedure can lead to worsening hypoxia. Careful management of ventilation is essential during rigid bronchoscopy or thoracotomy to prevent hypoxemia. Continuous monitoring of oxygen saturation and early recognition of changes in respiratory parameters can mitigate this risk.

Hemodynamic Instability:

Thoracotomy procedures, in particular, may result in hemodynamic fluctuations due to the invasive nature of the surgery. Significant blood loss, changes in intrathoracic pressure, and manipulation of mediastinal structures may lead to hypotension or arrhythmias. Close monitoring and appropriate pharmacologic support are necessary to maintain cardiovascular stability throughout the procedure.

Arterial line monitoring is invaluable in such cases to detect early hypoxemia, acid–base disturbances, arrythmias and haemodynamic fluctuations.

Postoperative Pain Management:

Effective pain control is essential in paediatric thoracic surgeries to ensure a smooth recovery and prevent complications such as atelectasis or hypoventilation. Epidural analgesia provides targeted pain relief with minimal systemic side effects, making it an ideal choice in paediatric thoracotomy cases. This method not only enhances comfort but also promotes early mobilization and breathing exercises, which are critical for preventing postoperative pulmonary complications.

Chronic FBA and Special Considerations

Foreign body aspiration (FBA) that remains undiagnosed or untreated for a prolonged period can lead to significant chronic pulmonary and airway pathology. Long-standing retention of a foreign body may result in recurrent lower respiratory tract infections, post-obstructive pneumonia, bronchiectasis, atelectasis, lung abscess formation, and progressive destruction of the distal lung parenchyma. In advanced cases, irreversible changes in the affected lung segments may necessitate surgical intervention, including bronchotomy, segmentectomy, or lobectomy, rather than bronchoscopic retrieval.

Chronic aspiration is frequently associated with persistent airway inflammation, granulation tissue formation, fibrosis, and bronchial stenosis. These pathological changes distort normal airway anatomy and significantly increase the difficulty of bronchoscopic visualisation and foreign body removal. From an anaesthetic perspective, repeated airway instrumentation and chronic inflammation predispose to airway oedema, friability, and bleeding, increasing the risk of airway trauma and peri-intubation complications. Meticulous airway evaluation and preparation for a difficult airway, including the availability of fibreoptic equipment and alternative airway strategies, are therefore essential.

Altered lung mechanics are a hallmark of chronic FBA. Obstructive and restrictive ventilatory defects may coexist due to airway narrowing, loss of lung compliance, and destruction of alveolar units. These changes complicate intraoperative ventilation, particularly during one-lung ventilation, with an increased risk of hypoxaemia, hypercapnia, and barotrauma. Pressure-controlled ventilation, careful titration of tidal volumes, and vigilant monitoring of end-tidal carbon dioxide and arterial blood gases are crucial to maintain adequate gas exchange.

Long-term foreign body retention also predisposes patients to secondary bacterial colonisation and infection, including infection with multidrug-resistant organisms such as methicillin-resistant *Staphylococcus aureus* (MRSA). Such infections can worsen pulmonary reserve and increase perioperative morbidity. Preoperative identification of infectious organisms, optimisation with appropriate antibiotic therapy, and strict adherence to infection control measures are vital. The anaesthesiologist should be prepared for prolonged perioperative antibiotic administration and potential sepsis-related haemodynamic instability.

Pain management poses an additional challenge in thoracic procedures performed for chronic FBA. Effective analgesia is critical to facilitate early mobilisation, adequate cough, and lung expansion, thereby reducing the risk of postoperative pulmonary complications. Regional techniques such as thoracic epidural analgesia play a pivotal role by providing superior pain control while minimising opioid-related respiratory depression.

In summary, chronic foreign body aspiration presents unique anaesthetic challenges due to distorted airway anatomy, compromised pulmonary function, and increased susceptibility to infection. Successful perioperative management requires comprehensive preoperative evaluation, meticulous airway planning, lung-protective ventilation strategies, effective regional analgesia, and close multidisciplinary collaboration to optimise patient outcomes.

CONCLUSION:

The management of a foreign body retained in the right main bronchus requires swift action, precise airway management, and team coordination. Chronic retention and prior airway manipulations significantly increase perioperative risk. In these high-stakes situation, fiberoptic bronchoscopy and advanced airway management, invasive monitoring and collaboration among multidisciplinary teams are key to ensuring the safety and best outcomes for the pediatric patient..

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