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Case Report
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A Complex Pediatric Case of Pulmonary Vascular Hypertension Following Foreign Body Inhalation, Viral-Induced Wheeze, Micronutrient Deficiencies, Immune Dysfunction and Colorectal Motility Disorder in a Toddler Simulating Status Asthmaticus

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Abstract

Pulmonary Vascular Hypertension (PVH) in early childhood is uncommon and often overlooked when children present with acute severe wheeze. We report a complex case of a 2-year-old girl with colorectal motility disorder, micronutrient deficiencies, immune dysfunction, and recurrent viral-induced wheeze who developed sudden severe respiratory distress. Her presentation mimicked status asthmaticus but was ultimately attributed to foreign body aspiration and unrecognised pulmonary vascular hypertension. Delayed diagnosis contributed to prolonged ventilatory instability, with the child responding only to muscle relaxants until the underlying pathology was identified. This case highlights the diagnostic challenges posed by multisystem comorbidities and emphasises the importance of holistic assessment, multidisciplinary collaboration, and awareness of PVH in atypical or refractory respiratory presentations. This manuscript describes an exceptionally challenging and educational case involving a 2-year-old girl whose presentation mimicked status asthmaticus but was ultimately attributed to a convergence of foreign body aspiration, viral-induced wheeze, micronutrient deficiencies, immune vulnerability, and unrecognised pulmonary vascular hypertension. The case highlights the diagnostic complexity created by multisystem comorbidities and illustrates how early assumptions can obscure life-threatening underlying pathology.

Keywords: Pulmonary Vascular Hypertension; Foreign Body Inhalation; Viral-Induced Wheeze; Toddler Respiratory Distress; Colorectal Motility Disorder; Micronutrient Deficiencies; Immune Deficiency; Aspiration Risk; Refractory Wheeze; Status Asthmaticus Mimic

Introduction

Foreign Body Aspiration (FBA) is a common cause of pediatric respiratory distress, often masquerading as asthma. While FBA typically causes localized lung injury, prolonged irritation can lead to systemic complications. Additionally, the coexistence of gut dysmotility and respiratory symptoms suggests shared pathophysiological mechanisms, potentially mediated by immune dysfunction or autonomic instability.

Foreign Body Aspiration (FBA) is a well-recognised cause of acute respiratory distress in toddlers, yet delayed diagnosis remains common when symptoms mimic viral-induced wheeze or asthma [1, 2]. Chronic airway obstruction, recurrent infections, and hypoxia may contribute to pulmonary vascular remodelling and pulmonary vascular hypertension [3-6]. Children with gastrointestinal dysmotility, micronutrient deficiencies, and immune dysfunction are particularly vulnerable to severe respiratory illness and diagnostic complexity [3,7-12].

This case illustrates how multiple interacting factors - colorectal motility disorder, aspiration risk, micronutrient deficiency, immune vulnerability, and viral infection - can converge to produce a clinical picture resembling status asthmaticus, masking the underlying pathology [8, 13]. It

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also underscores the importance of recognising PVH as a potential contributor to refractory respiratory failure [1, 4-6].

We report the case of a 2-year-old girl who presented with a severe respiratory episode mimicking status asthmaticus. Initial refractory symptoms were later attributed to the synergistic effects of an undiagnosed inhaled foreign body and an acute viral infection. Subsequent investigations revealed secondary pulmonary vascular hypertension, likely exacerbated by chronic inflammation and recurrent hypoxia. The case was further complicated by an underlying colorectal motility disorder, multiple micronutrient deficiencies, and a primary immune deficiency. This report highlights the diagnostic challenges of "pseudo-asthma" in toddlers and the importance of a multidisciplinary approach in managing multi-system pediatric disorders.

Case Report

A 2-year-old girl, born at term and who passed meconium and urine within the first few hours of life, had experienced chronic constipation since early infancy and carried a diagnosis of colorectal motility disorder. She presented with sudden-onset severe respiratory distress following several days of cough, fever, and reduced oral intake. Her past medical history included bronchiolitis in infancy, chronic constipation, feeding difficulties, and poor weight gain. She had multiple general practitioner attendances for viral-induced wheeze and recurrent upper respiratory tract infections.

Her parents reported intermittent choking episodes during meals and described a recent event in which she abruptly coughed while playing with small plastic pearls, although she appeared to recover quickly at the time. She was reviewed by her general practitioner, who referred her to the emergency department of the local district hospital. She was admitted to the paediatric ward and subsequently transferred to the Paediatric Intensive Care Unit (PICU).

On examination, the child appeared acutely unwell, with perioral cyanosis and marked subdiaphragmatic and jugular retractions. Her oxygen saturation was 78% on room air, and her respiratory rate was 60–65 breaths/min. Chest examination revealed bilaterally reduced air entry with wheezing. Abdominal examination showed rectosigmoid loading with palpable fecalomas. There was no lymphadenopathy, no skin changes, and no evidence of trauma.

Laboratory investigations demonstrated multiple micronutrient deficiencies (iron, zinc, vitamin D, selenium), reduced IgA with borderline low IgG subclasses, moderately elevated inflammatory markers, and a positive rhinovirus/enterovirus PCR.

The differential diagnosis included status asthmaticus, viral-induced wheeze with secondary bacterial infection, Foreign Body Aspiration (FBA), aspiration pneumonitis, immune deficiency with recurrent infections, and malnutrition-related respiratory muscle weakness. Pulmonary vascular hypertension secondary to chronic hypoxia was not initially considered.

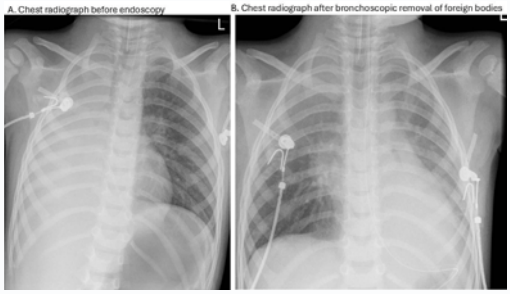

Figure 1: A. Chest radiograph prior to foreign body removal. Frontal chest X-ray showing right-sided whiteout of the right lung with mediastinal shift across to the right implying underlying collapse due to obstructive foreign bodies in the right main bronchus. The radiolucent pearls are not clearly visible but suggested by asymmetrical ventilation. **B.** Chest radiograph following removal of two pearl foreign bodies. Post-bronchoscopy chest X-ray demonstrating improved aeration and resolution of air trapping. The right lung fields show re-expansion and improved ventilation.

She received nebulised epinephrine, followed by salbutamol and ipratropium bromide. Chest radiography demonstrated complete opacification of the right hemithorax with hyperinflation of the left lung and mediastinal shift to the right (Figure 1A). Despite high-flow oxygen, her saturations fluctuated. Cardiovascular examination revealed tachycardia and a loud second heart sound. Growth parameters were below the 3rd centile, and she appeared pale and fatigued, with clinical signs of micronutrient deficiency (brittle hair, angular cheilitis).

Initially, para-infectious wheeze was suspected due to her history of recurrent viral-associated wheezing and the presence of fever and diffuse wheeze. However, when she showed minimal response to bronchodilators, steroids, and magnesium sulphate, the working diagnosis was revised to presumed status asthmaticus. She was transferred urgently to a tertiary university hospital PICU on Good Friday, where she required ventilation and muscle relaxants - the only intervention that consistently stabilised her. This management continued over the weekend. Blood gases showed persistent hypoxia with mild hypercapnia.

On Easter Monday, a visiting senior clinical fellow with extensive experience in paediatric tracheobronchial foreign bodies and colorectal motility disorders joined the PICU team. During the ward round, the fellow noted marked asymmetry in chest movement, with significantly reduced airflow in the right hemithorax. Auscultation revealed a unilateral, high-pitched inspiratory wheeze resembling a whistle, with variable expiratory findings. The combination of sudden choking, transient improvement, and the radiographic findings prompted a detailed re-examination of the history with the parents, raising strong suspicion of FBA. Notably, during previous episodes of para-infectious wheeze, the child had never exhibited such profound hypoxia or severe dyspnea.

Diagnosis and Treatment

Given the severity of her condition and the high suspicion of FBA, the team proceeded with emergency flexible diagnostic bronchoscopy in the PICU. A large pearl with a central lumen was

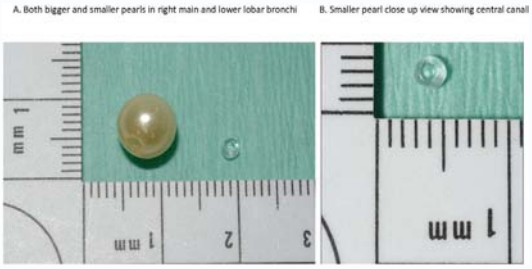

Figure 2: Retrieved foreign bodies: two plastic pearls with central holes. Photograph of the two aspirated foreign bodies - small cylindrical plastic pearls with central lumens - removed via rigid bronchoscopy. Granulation tissue was noted surrounding the objects.

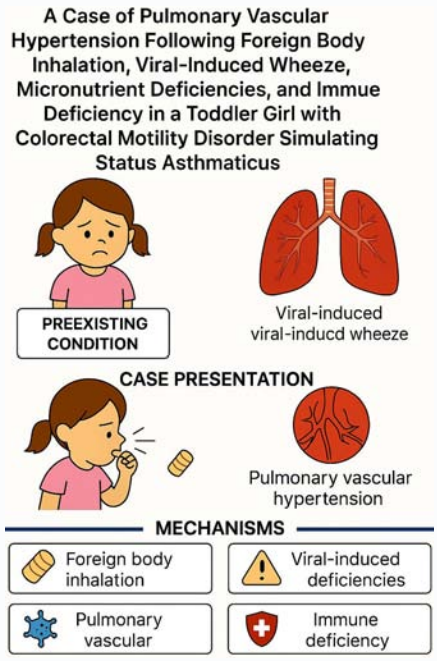

Figure 3: Graphical abstract summarising case progression and mechanisms. Infographic illustrating the multisystem interplay leading to pulmonary vascular hypertension in a toddler girl. Panels depict the patient, preexisting colorectal motility disorder, foreign body inhalation, viral-induced wheeze, micronutrient deficiencies, immune dysfunction, and final diagnosis.

visualised obstructing the right main bronchus. As therapeutic removal required rigid bronchoscopy, she was immediately referred to the Head and Neck Surgery team, who successfully extracted the large pearl.

However, air entry to the right lower zone remained absent. Repeat rigid bronchoscopy revealed a second, smaller pearl lodged in the right lower lobe bronchus (Figure 2). Following removal, chest radiography showed re-expansion of the right lung with restored aeration throughout (Figure 1B). The anesthetic team discontinued muscle relaxants, anticipating clinical improvement.

Further Course

Within 1–2 hours, the patient again developed progressive desaturation. Both clinical examination and chest radiography were unremarkable, yet any handling - including airway suction - precipitated significant desaturation. The fellow and anesthetic registrar agreed there was no mechanical obstruction but requested consultant anesthetic review. Although the endotracheal tube

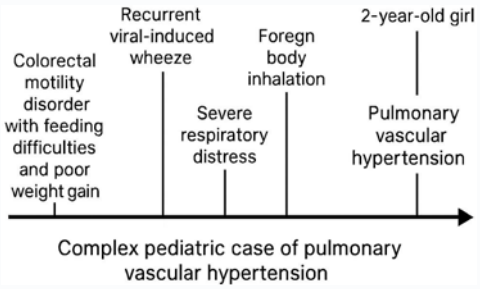

Figure 4: Timeline of clinical progression. Schematic timeline showing key events: baseline gastrointestinal dysmotility, recurrent viral wheeze, foreign body inhalation, acute respiratory distress, and diagnosis of complex pediatric pulmonary vascular hypertension.

appeared patent, it was replaced under the principle of "when in doubt, take it out." A short-acting muscle relaxant temporarily stabilised the patient for approximately 30 minutes before the deterioration recurred.

The fellow emphasised that the only consistent stabilising factor was muscle relaxation and proposed continuing this approach until the PICU consultant returned from an external retrieval. A single dose of long-acting muscle relaxant was administered to bridge this period.

When the consultant returned, the same deterioration pattern recurred. Despite repeated interventions by the PICU and anesthetic teams, the patient's condition worsened with each attempt to reduce sedation or stimulation. Ultimately, the fellow recommended reinstating continuous muscle relaxation and gradually weaning only after nutritional status improved and further investigations were completed. This plan was accepted. The patient remained stable on muscle relaxants and was slowly weaned over six weeks, eventually being discharged home in good condition at eight weeks.

She received supportive ventilatory care, nutritional rehabilitation, and treatment for micronutrient deficiencies. Immunology and gastroenterology teams established long-term plans for immune monitoring and management of her colorectal motility disorder.

Outcome and Follow-Up

Over subsequent weeks, her respiratory symptoms improved markedly. Weekly multidisciplinary grand rounds involving PICU, paediatric anaesthesia, and paediatric emergency medicine teams reviewed her progress and management. Nutritional supplementation resulted in improved energy levels and catch-up growth. A coordinated long-term plan was established with respiratory, cardiology, immunology, gastroenterology, and dietetics teams.

During this period, administrative issues arose when a PICU consultant sought to conclude the visiting international fellow's placement early. A misunderstanding led to an inappropriate referral of the fellow to the regulatory body by an external consultant unfamiliar with the case. During the investigation, the fellow presented detailed clinical evidence demonstrating that unrecognised pulmonary vascular hypertension - and the team's limited experience with this pathology - had contributed to the child's deterioration. This was acknowledged, and the hospital subsequently requested formal teaching and training on paediatric pulmonary vascular hypertension. The visiting fellow was commended for identifying the missing diagnostic link and improving future care pathways.

Discussion

We believe this case is of significant clinical value because:

- It demonstrates how foreign body aspiration may be masked by recurrent viral wheeze and misinterpreted as refractory asthma [2, 7].
- It underscores the importance of considering pulmonary vascular hypertension in children with disproportionate hypoxia or paradoxical responses to routine interventions [1, 4-6].
- It illustrates the interplay between gastrointestinal dysmotility, aspiration risk, micronutrient deficiency, and immune dysfunction in shaping respiratory outcomes [3, 9-14].
- It provides a systems-level learning opportunity regarding multidisciplinary collaboration, escalation pathways, and the importance of specialist input in complex paediatric presentations.

This case highlights the diagnostic complexity that arises when multiple comorbidities converge in a young child presenting with acute respiratory distress. The initial clinical picture strongly resembled status asthmaticus, a common and often straightforward diagnosis in pediatrics. However, the child's lack of response to bronchodilators, steroids, and magnesium sulphate signaled an atypical course requiring deeper investigation [8, 13].

Foreign body aspiration is a well-known cause of sudden respiratory compromise in toddlers, yet diagnosis is frequently delayed when symptoms overlap with viral-induced wheeze [2, 7]. In this case, the presence of rhinovirus/enterovirus infection, fever, and diffuse wheeze initially masked the underlying obstruction. The "honeymoon period" following aspiration - where symptoms temporarily improve - further contributed to diagnostic delay [2].

The child's colorectal motility disorder increased her risk of choking due to dysmotility-related feeding difficulties [3, 14, 15]. Micronutrient deficiencies and immune dysfunction compounded her vulnerability to severe respiratory illness and impaired recovery [9-12]. These factors created a clinical environment in which viral wheeze, aspiration, and hypoxia interacted synergistically.

A striking feature of this case was the child's dependence on muscle relaxants for respiratory stability. This paradoxical response prompted reconsideration of the underlying physiology. Persistent hypoxia from prolonged airway obstruction likely contributed to pulmonary vascular hypertension, a condition rarely considered in acute wheezing presentations [1, 4-6]. PVH can cause profound desaturation with minimal stimulation, explaining the child's deterioration during handling and suctioning [1, 4-6].

The turning point occurred when a clinician with specific expertise recognised the asymmetry in chest movement and the characteristic unilateral inspiratory "whistle." This underscores the importance of experience, pattern recognition, and multidisciplinary collaboration in complex paediatric cases.

The subsequent institutional reflection and training initiative highlight the broader systems-level learning that can emerge from a single case. The fellow's role in identifying the missing diagnostic link ultimately improved future care pathways - a reminder that clinical humility and curiosity are essential in paediatric practice.

We believe this case will be of interest to clinicians in pediatrics, emergency medicine, respiratory medicine, anaesthesia, and critical care, and will contribute meaningfully to the literature on diagnostic delay, foreign body aspiration, and paediatric pulmonary vascular hypertension [1-16].

Learning Points

- Foreign body aspiration should be considered in any child with sudden respiratory distress, especially when symptoms are unilateral or refractory to bronchodilators.
- Pulmonary vascular hypertension may complicate prolonged hypoxia and should be considered when desaturation is disproportionate or triggered by minimal stimulation.
- Micronutrient deficiencies and immune dysfunction can exacerbate respiratory illness and impair recovery.
- Children with gastrointestinal motility disorders are at increased risk of aspiration and choking events.
- Multidisciplinary collaboration and careful re-evaluation of the clinical picture are essential when a child does not respond to standard asthma therapy.
- Think Beyond Asthma: Refractory "status asthmaticus" in toddlers should always prompt a high index of suspicion for foreign body aspiration, even without a witnessed choking event.
- Secondary PH: Chronic FBA and recurrent viral infections can serve as triggers for pulmonary vascular hypertension in susceptible children.
- The Gut-Lung Axis: Colorectal motility disorders may coexist with respiratory symptoms, potentially linked by underlying immune deficiencies.
- Multivariate Deficiencies: Multiple micronutrient deficiencies can significantly impair immune function and delay recovery from acute respiratory insults.

Conclusion

This case illustrates how a seemingly common presentation of acute severe wheeze in a toddler can mask a far more complex interplay of underlying conditions. The convergence of foreign body aspiration, viral-induced wheeze, micronutrient deficiencies, immune vulnerability, and colorectal motility disorder created a clinical picture that closely simulated status asthmaticus and initially obscured the true diagnosis. The child's paradoxical dependence on muscle relaxants and disproportionate hypoxic responses highlighted the presence of unrecognised pulmonary vascular hypertension, a diagnosis rarely considered in this context.

The case underscores the importance of maintaining diagnostic openness when a child fails to respond to standard asthma therapy, particularly when clinical asymmetry, choking events, or atypical deterioration patterns are present. It also demonstrates the value of multidisciplinary collaboration and the critical role of specialist insight in identifying subtle but decisive clinical clues. Beyond the individual patient, this case prompted institutional reflection and education, strengthening future recognition and management of paediatric pulmonary vascular hypertension.

Ultimately, the child's recovery was made possible by careful reassessment, timely intervention, and a holistic approach that addressed not only the airway obstruction but also the broader nutritional, immunological, and physiological contributors to her illness. This case serves as a reminder that complex paediatric presentations require curiosity, vigilance, and a willingness to revisit assumptions to ensure accurate diagnosis and optimal care.

Patient's Perspective

"As parents, the sudden deterioration of our daughter was terrifying. What began as what we thought was another episode of viral wheeze quickly became the most frightening experience of our lives. Watching her struggle to breathe, not knowing why she was getting worse, and seeing her moved to intensive care was overwhelming.

We were grateful when the team took the time to re-examine her history and listen to our concerns about the choking episode. Once the foreign bodies were found and removed, we finally felt some hope, although her continued instability was confusing and distressing. The period when she could only remain stable on muscle relaxants was particularly difficult, as we did not understand why she reacted so severely to even small movements.

Over the following weeks, we saw her slowly regain strength. The multidisciplinary support, clear communication, and careful monitoring helped us feel reassured. We now understand how complex her condition was and how many factors contributed to her illness. We are thankful for the clinicians who persisted, asked questions, and looked beyond the obvious. Their dedication helped our daughter recover, and we feel more confident about her long-term care.

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