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CONGENITAL TRACHEOBRONCHIAL STENOSIS IN A 7-MONTH-OLD INFANT: A MULTIDISCIPLINARY APPROACH TO MANAGEMENT

Sheikh Irfan Basha[1*], Alia Abdullah[2], Mohammad Nasir Ansari[3], Aboobacker Vayankara Valancheri[4], Ashutosh Goyal[5], Mohamed Ali Othman[6]

[1*]mbbs, Ms (Ent), Frcs, Consultant Ent, Sheikh Khalifa Medical City. Sibasha25@Gmail.Com
[2]mbbs, Mrcs, Sheikh Khalifa Medical City. Aforalia@Gmail.Com
[3]md Paediatric, Mrcpch, Paediatric Icu, Shaikh Khalifa Medical City, Abudhabi Uae. Gtbnasir@Gmail.Com
[4]mbbs, Md Pediatrics, Workplace: Sheikh Khalifa Medical City, Abu Dhabi, U.Ae. Drabooba@Gamil.Com
[5]md, Mrcpch, Pediatric Cardiology Division, Sheikh Khalifa Medical City Abudhabi. Ashutoshgoyal2000@Gmail.Com
[6]msc In Pediatric, Mrcpch, European Board Of Paediatrics, Pediatric Specialist, Nmc Provita, Abu Dhabi, Uae. Drmaosmanh@Gmail.Com

***Corresponding Author: -** Sheikh Irfan Basha
[*]mbbs, Ms (Ent), Frcs, Consultant Ent, Sheikh Khalifa Medical City, Sibasha25@Gmail.Com

Abstract
Congenital tracheobronchial stenosis presents complex challenges in pediatric respiratory care. This study delves into the intricate management of severe upper airway obstruction through a detailed case presentation of Felicity, a 7-month-old infant with congenital tracheobronchial stenosis. Felicity's medical journey commenced with a challenging birth marked by respiratory distress and difficulties in intubation, prompting suspicion of congenital anatomical malformation. Transferred to Al Jalila Hospital and later to Sheikh Khalifa Medical City ICU, she underwent extensive interventions, including tracheoplasty and multiple dilatation procedures, to alleviate airway stenosis. Despite surgical efforts, Felicity remains oxygen-dependent due to chronic respiratory failure and faces recurrent episodes of respiratory distress. She relies on a gastrostomy tube for enteral feeding due to unsafe swallowing secondary to airway obstruction. Diagnostic imaging revealed severe tracheal stenosis, emphasizing the severity and complexity of her condition. The multidisciplinary approach undertaken, involving Pediatric ENT, Pulmonology, Surgery, and nutritional specialists, underscores the collaborative efforts required for managing congenital airway anomalies. This case highlights the ongoing challenges in achieving sustained airway patency and emphasizes the need for continued research and advancements in pediatric respiratory care for optimal outcomes in complex airway anomalies.

Keywords: Congenital Tracheobronchial Stenosis, Infant, Multidisciplinary Approach, Tracheoplasty, Respiratory Failure, Gastrostomy Tube Feeding

Introduction

Congenital tracheobronchial stenosis is an infrequent yet intricate medical condition that presents significant challenges in the management of pediatric patients. The term encompasses a spectrum of abnormalities characterized by the narrowing of the trachea and bronchi, posing complexities in airway patency and respiratory function. Such cases necessitate a multidisciplinary approach for optimal care, involving Pediatric ENT, Pulmonology, and Surgery teams, highlighting the multifaceted nature of the condition (1).

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The incidence of congenital tracheobronchial stenosis is rare, making each case unique and demanding personalized therapeutic strategies. In neonates, the condition often manifests with respiratory distress shortly after birth, requiring prompt intervention and specialized care (2). In this context, we present a compelling case study of Felicity, a 7-month-old ex-preterm infant, who faced the challenges of severe upper airway stenosis, leading to chronic respiratory failure and failure to thrive.

This case underscores the intricate nature of congenital airway anomalies, emphasizing the critical importance of early diagnosis and a coordinated effort among various medical specialties. The rarity and complexity of these cases necessitate a nuanced understanding of the underlying pathology, effective surgical interventions, and long-term management strategies to optimize patient outcomes (3).

As documented in the literature, congenital tracheobronchial stenosis cases often require a combination of surgical procedures, including tracheoplasty, tracheostomy, and balloon dilatation, to address the anatomical abnormalities and ensure adequate airway function (4). While advances in diagnostic imaging techniques, such as CT scans, provide valuable insights into the extent and severity of the stenosis, the management of these cases remains a clinical challenge (5).

In this report, we delve into the clinical course of Felicity, detailing the diagnostic findings, operative procedures, and ongoing challenges she faces. By exploring this case, we aim to contribute to the growing body of knowledge surrounding the management of congenital tracheobronchial stenosis, shedding light on the complexities involved and emphasizing the need for continued research and collaborative efforts in pediatric respiratory care.

Case presentation

Felicity, a 7-month-old ex-preterm infant born at 30 weeks with a birth weight of 1.3 kg, exhibited failure to thrive and significant respiratory distress immediately after birth. Born at a private hospital in Dubai, her initial moments were marked by a lack of crying at birth, and a challenging intubation procedure hinted at potential congenital anatomical malformations. Due to these concerns, she was swiftly transferred to Al Jalila Hospital for further evaluation and management.

At Al Jalila Hospital, attempts were made to insert a 2.0 oral endotracheal tube, but ventilation through this narrow passage was challenging. Efforts to bypass the tracheal/subglottic stenosis via tracheostomy were unsuccessful. A subsequent CT scan on 08 December 2022 unveiled severe tracheal stenosis and narrowing of the right main bronchus. Her course in the hospital was complicated by a left-sided chest pneumothorax, necessitating the insertion of a pigtail tube. Concurrently, there was suspicion of necrotizing enterocolitis (NEC), managed conservatively. Due to the complexity of her condition, Felicity was later transferred to the ICU at Sheikh Khalifa Medical City on 05 February 2023 for specialized ENT and thoracic surgical assessments and management.

Sheikh Khalifa Medical City ICU Course:

A CT scan on 06 February 2023 confirmed the severity of Felicity's condition. The imaging revealed a complete tracheal ring at the thoracic inlet, leading to marked narrowing of the thoracic trachea down to its bifurcation, with similar narrowing observed in the right main bronchus.

To address these critical issues, Felicity underwent tracheoplasty on 09 February 2023. However, subsequent attempts at extubation failed, necessitating non-invasive ventilation, which resulted in multiple episodes of respiratory acidosis.

Throughout her stay, Felicity encountered numerous complications, notably multiple incidents of ventilator-associated pneumonia caused by pathogens such as Pseudomonas, Klebsiella, and Enterobacter hormaechei. To combat her severe failure to thrive, she was initiated on total parenteral nutrition.

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Despite interventions, she remained oxygen-dependent and faced challenges with tracheostomy changes, including failed attempts with the Swedish nose apparatus due to blockages by secretions. Balloon dilatations of the tracheal stenosis were performed on multiple occasions through laryngotracheoscopy by Dr. Basha.
Additionally, Felicity underwent a gastrostomy tube insertion without fundoplication on 23 June 2023, addressing her nutritional needs due to unsafe swallowing resulting from upper airway obstruction and tracheostomy.

Resolved Issues:
During her stay, several issues showed improvement, including cholestasis, transaminitis, hypercalcemia, normalized thyroid function tests (TFT), thrombocytopenia, and anemia.
Felicity's complex medical journey illustrates the challenges inherent in managing severe upper airway stenosis in pediatric patients and underscores the need for ongoing specialized care and multidisciplinary interventions.

Clinical Course:
Felicity's clinical journey commenced with her birth, characterized by a lack of crying and challenging intubation, hinting at congenital anatomical malformation. Transferred to Al Jalila Hospital, she faced severe tracheal stenosis and right main bronchus narrowing, leading to respiratory distress. Subsequent care at Sheikh Khalifa Medical City ICU involved tracheoplasty, ventilator support, and management of ventilator-associated pneumonia. Despite interventions, she remained oxygen-dependent, encountering recurrent respiratory distress and tracheostomy care challenges.

Diagnostic Findings:
Imaging studies, notably CT scans, revealed the extent of Felicity's condition. The scans indicated severe tracheal stenosis extending to the thoracic inlet, resulting in marked bronchial narrowing. These findings highlighted the complexity and severity of her upper airway obstruction.

Operative Details:
Surgical interventions aimed to alleviate Felicity's airway stenosis. Tracheoplasty was performed to address the narrowed trachea and bronchi. Additionally, balloon dilatation procedures and tracheostomy tube changes were conducted to optimize airway patency. The operative notes emphasized the challenges faced during procedures due to the severity and extent of the stenosis, necessitating intricate surgical techniques for repair and maintenance of the airway.

Current Status:
Despite multiple interventions, Felicity remains oxygen-dependent due to chronic respiratory failure caused by upper airway stenosis. Her challenges persist, including recurrent episodes of respiratory distress and difficulties in weaning off respiratory support. She continues to rely on a gastrostomy tube for enteral feeding due to unsafe swallowing secondary to upper airway obstruction. Ongoing efforts focus on meticulous respiratory and nutritional management alongside clonidine weaning.
This comprehensive overview captures Felicity's medical trajectory, illustrating the persistent challenges posed by congenital tracheobronchial stenosis and the multifaceted interventions undertaken to manage her complex condition.

Discussion
Felicity's case of congenital tracheobronchial stenosis exemplifies the intricate challenges encountered in managing severe upper airway obstruction in pediatric patients. This discussion

elucidates the complexities, the limitations of current interventions, and the implications for long-term management and future research.

The severity of Felicity's stenosis necessitated multiple interventions, including tracheoplasty and balloon dilatations, reflecting the complexity of managing congenital airway anomalies. Despite surgical attempts, her persistent dependence on oxygen therapy underscores the limitations in achieving optimal airway patency and functional improvement. The management of Felicity's condition required a coordinated effort involving Pediatric ENT, Pulmonology, Surgery, and nutritional specialists. This multidisciplinary approach underscores the necessity of collaborative care in addressing the diverse challenges posed by congenital tracheobronchial stenosis (5-8).

Operative interventions, detailed in Felicity's case, emphasized the technical complexities encountered during procedures due to the extensive and severe nature of the stenosis. The surgical notes underscored the challenges in achieving and maintaining adequate airway dimensions, suggesting the need for innovative surgical techniques in managing such complex cases. Felicity's persistent oxygen dependency and recurrent respiratory distress highlight the profound impact of tracheal stenosis on respiratory function. Despite interventions, her respiratory status remains critical, reflecting the enduring challenges in managing chronic respiratory failure associated with congenital airway anomalies (6-9).

The utilization of a gastrostomy tube for enteral feeding due to unsafe swallowing secondary to airway obstruction underscores the multifaceted nature of care in these cases. Challenges in achieving adequate nutrition while managing respiratory issues highlight the intricacies of comprehensive patient care. The complexity and limited success in managing Felicity's condition emphasize the need for continued research and advancements in surgical techniques and therapies targeting congenital tracheobronchial stenosis. Novel approaches, including tissue engineering and genetic therapies, may offer promising avenues for improving outcomes in such cases (5-10).

Conclusion

In conclusion, Felicity's case of congenital tracheobronchial stenosis exemplifies the intricate challenges in pediatric respiratory care. Despite multifaceted interventions, her chronic respiratory failure and reliance on oxygen therapy persist, emphasizing the limitations in achieving sustained airway patency. The multidisciplinary approach undertaken highlights the collaborative efforts required for managing such complex conditions. Felicity's case underscores the critical need for further advancements in surgical techniques and therapies to address severe upper airway obstructions in pediatric patients effectively. Continued research exploring innovative interventions and long-term follow-up strategies is imperative to enhance outcomes and quality of life for patients facing congenital airway anomalies. This case serves as a reminder of the ongoing complexities in managing congenital tracheobronchial stenosis and underscores the necessity for ongoing specialized care and advancements in the field.

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