Case Report

Usage of Foley's catheter in pediatric lung isolation, whole lung lavage: A case report

ABSTRACT

This case report delves into pediatric lung isolation challenges and innovations in managing patients with pulmonary alveolar proteinosis undergoing whole lung lavage. The central focus is on a 5-year-old girl who initially encountered intraoperative complications, including bilateral pneumothorax and pulmonary edema. However, a subsequent attempt employing a Foley's catheter for lung isolation proved successful, with the patient displaying marked postoperative improvements. The case offers valuable insights into the intricate balance of anesthesia, ventilatory parameters, and the novel use of common medical equipment, like the Foley's catheter, for specialized procedures in pediatric pulmonology.

Key words: Pediatric anesthesia, pediatric lung isolation, pulmonary alveolar proteinosis, whole lung lavage

Introduction

Over the past few decades, pediatric anesthesia and respiratory care have significantly evolved to improve the safety and efficacy of interventions in children. A notable challenge in pediatric respiratory management is pulmonary alveolar proteinosis (PAP). This rare ailment results from surfactant accumulation in the alveoli, impairing gas exchange and potentially causing progressive respiratory failure.[1,2] The cornerstone treatment for PAP is whole lung lavage (WLL), which clears this accumulation.[3] However, achieving lung isolation for unilateral WLL in pediatric patients is daunting due to their unique anatomical and physiological features and the unavailability of suitable lung isolation devices.

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The challenge stems from the diminutive size of the pediatric tracheobronchial tree and the absence of appropriately sized double-lumen tubes or bronchial blockers, which are standard for adults.[4] Consequently, there's been a push to innovate techniques for effective lung isolation to ensure safe WLL in children.

Enter the Foley's catheter, originally designed for urinary bladder catheterization. Its flexibility, size adaptability, and balloon-tipped end make it a potent solution for pediatric lung isolation.[5] Though initially used in adults, its application in children introduces a groundbreaking solution. Besides its functionality, the Foley's catheter is advantageous due to its wide

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Narjes S. Alotaibi, Osamah Arafah[1], Khalid Aljonaieh[1], Feras Ayaz[1], Hanan A. L. Hinai[2]

Department of Anesthesia, Unaizah College of Medicine and Medical Sciences, Qassim University, Unaizah, [1]Department of Anesthesia, King Faisal Specialist Hospital and Research Centre, Kingdom of Saudi Arabia, [2]Department of Anesthesia, Sultan Qaboos University Hospital, Muscat, Oman

Address for correspondence: Dr. Narjes S. Alotaibi, Unaizah College of Medicine and Medical Sciences, Qassim University, Unaizah, Kingdom of Saudi Arabia, P.O. Box 991, Postal Code 51911 Unaizah, Kingdom of Saudi Arabia.
E-mail: n.alnajdialotaibi@qu.edu.sa

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availability, cost-efficiency, and the general familiarity clinicians have with it.[6]

Effective lung isolation is vital during WLL to lavage one lung while keeping the other ventilated, ensuring oxygenation and carbon dioxide elimination.[6] Inadequate isolation might inundate the ventilated lung, risking severe hypoxemia. Thus, a consistent, trustworthy, and safe pediatric lung isolation method is essential. The Foley's catheter, a commonly available device, marks a pivotal development in pediatric anesthesiology and pulmonology.

Case Presentation

A 5-year-old girl, diagnosed with PAP, was admitted to the pediatric intensive care unit (PICU) due to severe respiratory distress. Initially, her scheduled pulmonary lavage was halted because of complications, including bilateral pneumothorax and pulmonary edema. After 48 hours of stabilization, a second lung lavage was attempted.

In the operating room, she was intubated with a 4.5-sized tube, with subsequent imaging revealing bilateral chest tubes and minimal residual pneumothorax on X-ray. Comprehensive monitoring was set up, including pulse oximetry, ECG, arterial blood pressure, and a capnograph. She was maintained on 3% sevoflurane, 100% FiO2, and a 3 L/min flow rate. Ventilation was set with a pressure of 20, respiration rate of 20, and positive end-expiratory pressure of 5, adjusted according to the EtCO2 readings.

For muscle relaxation, intravenous Rocuronium (1 mg/kg) and Fentanyl (2 mcg/kg) were given. The endotracheal tube (ETT) was then replaced with a size 4 cuffed tube, correctly positioned above the carina. Then, with the aid of bronchoscope direct visualization inserted inside ETT, Foley's catheter size 10 French with the guide wire introduced alongside ETT to the left main stem, balloon of the Foley's catheter was inflated. Lavage of the left lung starts through Foley's catheter, using a 50 cc catheter tip syringe with a perfect air-tight seal, after completing the lavage with no leak, the balloon of the Foley's catheter deflated and repositioned to the right main bronchus using a bronchoscope for similar lavage.

Post successful lavage, the Foley's catheter was removed. The patient remained hemodynamically stable without any pulmonary issues. She returned to the PICU intubated and was extubated after a 2-day postoperative stay. Her pulmonary function significantly improved, nearing baseline. The child was soon off supplemental oxygen, exhibited a regular respiratory pattern, and resumed age-appropriate playful activities, indicating a return to her typical health.

Discussion

PAP is a rare lung disorder that presents both diagnostic and therapeutic challenges.[7] Characterized by the accumulation of surfactant in the alveoli, PAP disrupts gas exchange, potentially leading to respiratory failure if untreated.[1] The primary treatment, WLL, aims to cleanse the bronchoalveolar system. While effective, performing WLL, especially in children, necessitates precise lung isolation. For adults, tools like double-lumen tubes or bronchial blockers are available.[4] However, pediatric cases often demand alternative solutions, leading to the innovative use of the Foley's catheter, typically used for urinary purposes.

The presented case of a 5-year-old diagnosed with PAP underscores the intricacies of pediatric WLL. The initial procedure's halt due to bilateral pneumothorax and pulmonary edema highlights the risks associated, emphasizing meticulous planning. The employed monitoring tools, including pulse oximetry, ECG, arterial blood pressure, and capnograph, were crucial for real-time physiological assessments, ensuring immediate responses to any deviations.

Anesthesia was maintained using 3% sevoflurane, with a FiO2 of 100% and 3 L/min flow rate, which is vital for prolonged procedures like WLL. The ventilatory settings were tailored for pediatric lungs, ensuring adequate ventilation while minimizing barotrauma risks. Additionally, the administration of Rocuronium ensured the suppression of spontaneous breathing, while Fentanyl provided pain relief and suppressed potential stress responses during WLL.

A remarkable innovation in this case was the Foley's catheter application. Given the challenges posed by pediatric airways, the Foley's catheter, with its adjustable balloon, provided an effective lung isolation method. This was corroborated by the successful lavage of both lungs. Using a bronchoscope ensured accurate catheter positioning.

The Foley's catheter's adaptability is its primary strength. Its balloon can be inflated once correctly positioned in the bronchus, allowing one lung to undergo lavage while the other remains ventilated, maintaining oxygenation and reducing hypoxemia risks.[8] Additionally, the simultaneous use of a bronchoscope enhances the catheter's placement precision, ensuring effective lung isolation and lavage efficiency. The Foley's catheter's design, slender and flexible, offers a suitable fit for the pediatric airway, especially

when considering the challenges posed by the pediatric tracheobronchial tree's size.[6]

Conclusion

The presented case offers a promising glimpse into the evolving strategies for managing pediatric PAP patients undergoing WLL. While pediatric lung isolation techniques have been reported in the literature and despite the procedure's overall expense, complexity, and morbidity, the innovative use of the Foley's catheter for lung isolation showcased its potential effectiveness and safety in this challenging procedure. This case serves as a testament to the adaptability of common medical devices for specialized needs and underscores the importance of continuous innovation in pediatric lung isolation methods.

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Conflicts of interest
There are no conflicts of interest.

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