

Subcutaneous emphysema of the neck as a complication of high flow therapy in children: A case report

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Abstract

High Flow Nasal Cannula (HFNC) is a noninvasive technique for respiratory support increasingly used in the pediatric wards for the management of respiratory failure. Few data are reported about the safety of HFNC. We describe the case of a 3-months-old infant admitted for acute bronchiolitis Respiratory Syncytial Virus-relat-

ed and treated with HFNC for severe respiratory distress. Twelve hours after the beginning of HFNC a subcutaneous swelling of the neck, attributable to subcutaneous emphysema, became clinically evident. Radiological imaging showed pneumomediastinum with air leaking up to the neck. Patient was moved to PICU where he further worsened due to a mediastinal shift requiring drainage and mechanical ventilation. He was then progressively weaned from ventilation and was discharged from the hospital. Pneumomediastinum may occur during HFNC, particularly in moderate-severe cases of acute bronchiolitis. Patients undergoing HFNC should be strictly monitored in order to promptly recognize this complication and treat the child appropriately.

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Introduction

Over the last decade, heated humidified High-Flow Nasal Cannula (HFNC) has become an increasingly used device for respiratory support in bronchiolitis, either alternative to traditional Low-Flow Nasal Cannula (LFNC) or to prevent more invasive methods such as continuous positive airways pressure and mechanical ventilation. It has been proved to be a well-tolerated non-invasive form of respiratory support,¹ which is frequently administered in the general pediatrics ward.²

Despite the medical literature supports the use of HFNC in bronchiolitis, further evidence of its safety is required.³ The unpredictable rise in positive airways pressure during HFNC has been reported as a possible contributory factor in developing respiratory air leaks.^{4,5} Pneumomediastinum is a rare condition which occurs when air leaks into the mediastinum leading to chest pain, increased work of breathing and voice distortion, and requires prompt recognition and management. The diagnosis can be a challenge in bronchiolitis, due to the age of the patients and to the respiratory symptoms and deterioration that are common in the disease itself. To date, only few cases of air leak syndrome as a complication of HFNC have been reported in children.⁶

Case Report

A 3-month-old infant came to our hospital for acute bronchiolitis. He was born at 29 weeks of gestational age from twin pregnancy with a birth weight of 1380g; after birth, he was admitted to the neonatal intensive care unit where he underwent surfactant treatment for respiratory distress syndrome and nasal Continuous Positive Airways Pressure (CPAP) for 7 days. Respiratory Syncytial Virus (RSV) prophylaxis with Palivizumab was not administered because of his gestational age >29 weeks.⁷

At admission to our general pediatrics ward, the infant had fever and rhinitis, was mildly tachypnoic (50 breaths per minute)

with no signs of respiratory distress and a normal peripheral oxygen saturation ($SpO_2 > 92\%$), with only few bilateral crackles at chest auscultation. The day after, SpO_2 fell to 88% and required oxygen supplementation with LFNC. Laboratory evaluation showed a White Blood Cell (WBC) count of $7,600/ml^3$ (L 26%, N 51%) and C-Reactive Protein (CRP) was 0.34 mg/dL; nasopharyngeal aspirate was negative for antigen detection of common respiratory viruses (RSV, metapneumovirus, influenza, parainfluenza, adenovirus) and *Bordetella pertussis*. Three days after admission we documented a further worsening of the respiratory pattern. Serum markers of bacterial infection still remained unchanged, and the chest X-ray showed multiple bilateral slight parenchymal consolidations, peripheral air trapping and a mild left pleural effusion. We decided to start High-Flow Nasal Cannula (HFNC), with an appropriate dimension thus not occluding more than 50% of his nares, at 2l/kg/min, as suggested by international recommendations,⁸ and a 45% fraction of inspired oxygen was required to maintain an SpO_2 over 92%. Twelve hours later, a subcutaneous swelling of the neck became evident with snow crunching feeling at palpation, attributable to subcutaneous emphysema at first with no worsening of clinical conditions. Radiological imaging showed pneumomediastinum with air leaking back up to the neck (Figure 1). Therefore, he was moved to the Pediatric Intensive Care Unit (PICU), where he showed signs of respiratory distress like increased respiratory rate (95 breaths per minute), jugular retractions, and nasal flaring. Because of the occurrence of a tension pneumothorax with a mediastinal shift, the patient required pressure support ventilation and the placement of a pleural drainage. Furthermore, considering the marked bronchospasm and in the impossibility of delivering bronchodilators by aerosolization, he received endovenous bronchodilators, in particular aminophylline and magnesium sulphate, in addition to antibiotic therapy and parenteral nutrition. After 8 days, weaning with noninvasive mechanical ventilation was started and after 14 more days he was discharged from the PICU with complete clinical resolution. Home discharge was possible 25 days after admission.



Figure 1. Pneumomediastinum and subcutaneous emphysema in the neck.

Discussion

Spontaneous air leak is a rarely described complication of bronchiolitis, due to the marked bronchiolar obstruction that heightens respiratory effort and intrapleural negative pressure; however, its real incidence remains unknown.⁹

The reported case suggests that HFNC might concur in the genesis of air leak syndromes especially if other risk factors for severe bronchiolitis, such as prematurity, are present. Among the few cases reported of air leak syndrome during HFNC, only one was a 2-month-old infant with bronchiolitis.⁶ Authors stated that high inspiratory volumes may have caused alveolar overdistention producing air leak syndromes. Though the pressure generated by HFNC in the distal airway is difficult to measure, it appears to be dependent on the size of the patient, the diameter of the nasal cannula compared to the nares and the flow rate.¹⁰ We suggest that other factors can be involved in overinflation, such as disease severity which can lead to increasing alveolar air trapping and a certain degree of bronchopulmonary dysplasia, related to the child's prematurity, even if it does not prevent the use of HFNC in this clinical setting.¹¹ Considering the increasing evidence of efficacy and use of HFNC,^{12,13} the clinical staff should strictly monitor the response to HFNC therapy especially for patients with severe bronchiolitis or with other risk factors. Subcutaneous emphysema as a sign of occult pneumomediastinum is a clinical indicator that must be early recognized to promptly consider the opportunity to move the child to a higher intensity care level for the best respiratory management and treatment.

Conclusions

Pneumomediastinum may occur during HFNC, particularly in moderate and severe cases of acute bronchiolitis. Clinical staff should screen the onset of subcutaneous emphysema of the neck as a possible early sign of occult pneumomediastinum, to recognize this serious complication and provide adequate monitoring and treatment.

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