Endobronchial valve placement for a severe pneumothorax in a child on ECLS

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LETTER TO THE EDITOR

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INTRODUCTION

Persistent air leak is uncommon in pediatrics. When simple drainage is insufficient, treatment in these selected cases becomes challenging, especially in the context of the underlying disease. Multiple treatment options are available, with considerable risk of morbidity and mortality.[1] This is even more so in patients on extracorporeal life support (ECLS). In this delicate balance, endobronchial valves (EBVs) offer both the advantage of being minimally invasive and the ability to selectively treat a segmental air leak. Contrary to adults, reports on the use of EBV in air leak in children is limited to only one report of four cases.[2] This report describes the successful placement of an EBV to treat a severe and intractable air leak and is the first report of its use in a child on ECLS.

CASE REPORT

An 11-year-old girl with end-stage lung failure due to cystic fibrosis (CF) was placed on veno-venous ECLS, as a bridge to lung transplantation. As per protocol, mechanical ventilatory settings were decreased to decrease the risk of barotrauma and ventilator-induced lung injury. Pressure control ventilation of 10 cm H_2O above positive end-expiratory pressure (PEEP) 10 cm H_2O, with a frequency of 10 breaths per minute, resulted in very low tidal volumes 0.5 to 1 mL/kg. Despite these measures, she developed a severe right-sided pneumothorax several weeks after the start of ECLS. A chest tube was placed, though high volume continuous air leak with a large pneumothorax and complete atelectasis persisted. One day later, a larger chest tube was placed and ventilator settings were further reduced to 5 cm H_2O above PEEP 7 cm H_2O without effect. Both a 5 Fr Arndt endobronchial blocker (Cook Medical, Bloomington, IN) and subsequently a 7 Fr Rusch EZ-blocker (Teleflex, Raleigh, NC), were placed and the balloons were inflated to block the right main bronchus. This stopped the air leak only temporarily (Panel A) due to balloon dislocation, and repositioning only provided resolution for 1 day. Before resorting to stopping mechanical ventilation, we placed an EBV, as there is large experience in adults at our center and there are some suggestions of its use in children in air leak syndromes.[2] Since the EZ-blocker was still in place, it was used to identify the broncho-pleural fistula. Using a flexible bronchoscope, the EZ-blocker was advanced into the right main bronchus. Through inflating the balloons in the different lobes and subsequent segments (Panel C) and monitoring air leak via the chest tube, a broncho-pleural fistula was identified in segment 8. A 4.0-LP Zephyr Endobronchial valve (Pulmonx Corporation, Redwood City, CA) (Panel D) was placed, after which the air leak subsided and the right lung showed significant improvement in aeration (Panel B). Unfortunately, in the subsequent week, the patient developed a pneumothorax on the left side. A chest drain was inserted and mechanical ventilation was stopped. Eventually, she surmised due to thrombotic complications 5 weeks after lung transplantation.

DISCUSSION

Persistent air leak is a challenging entity and even in adult literature management is mostly based on anecdotal evidence and with varying success.[1] In CF there is no conclusive evidence whether chemical pleurodesis or surgical intervention is preferable in the treatment of air leak.[3] There are no data on the use of EBV in persistent air leak in patients with CF. In ECLS, where anticoagulation therapy is necessary, the risk of bleeding due to invasive procedures is considerably larger. A low risk, minimally invasive procedure is therefore preferable, as stopping ventilation increases the difficulty to clear the lungs of (infectious) secretions, which is especially important in CF. EBVs offer this treatment option in persistent air leak. In adults, evidence stems from case series in which they are effective in the large majority of cases[1,4] and a randomized controlled multicenter interventional trial is underway (https://clinicaltrials.gov/NCT023382614). In children, the use of EBV for persistent air leak is limited to only one small case series of four cases with good clinical results.[2] Besides being minimally invasive, EBV have the advantage of being relatively easy to place. In addition, the valve can be removed once the air leak has subsided. With the smallest valves currently being 4 mm, size might be an issue, though successful placement has been reported in a 7.7-kg child.[2] Though results are promising, there is much that remains unanswered. In adults, complications of, for example, migration, pneumonia, and hemoptysis have been reported,[5] but in children, the risks are unknown. Though minimally invasive, both flexible bronchoscopy and placing the EBV carry a risk of bleeding in patients on ECLS. Therefore an EZ-blocker was primarily used, as it is positioned in the main bronchus and therefore easier to place with lower risks. Other important questions concerning EBV are the place and timing in the treatment of air leak. It is unknown which underlying pneumothorax etiology is likely to respond to EBV treatment and which is not. Answers will only be

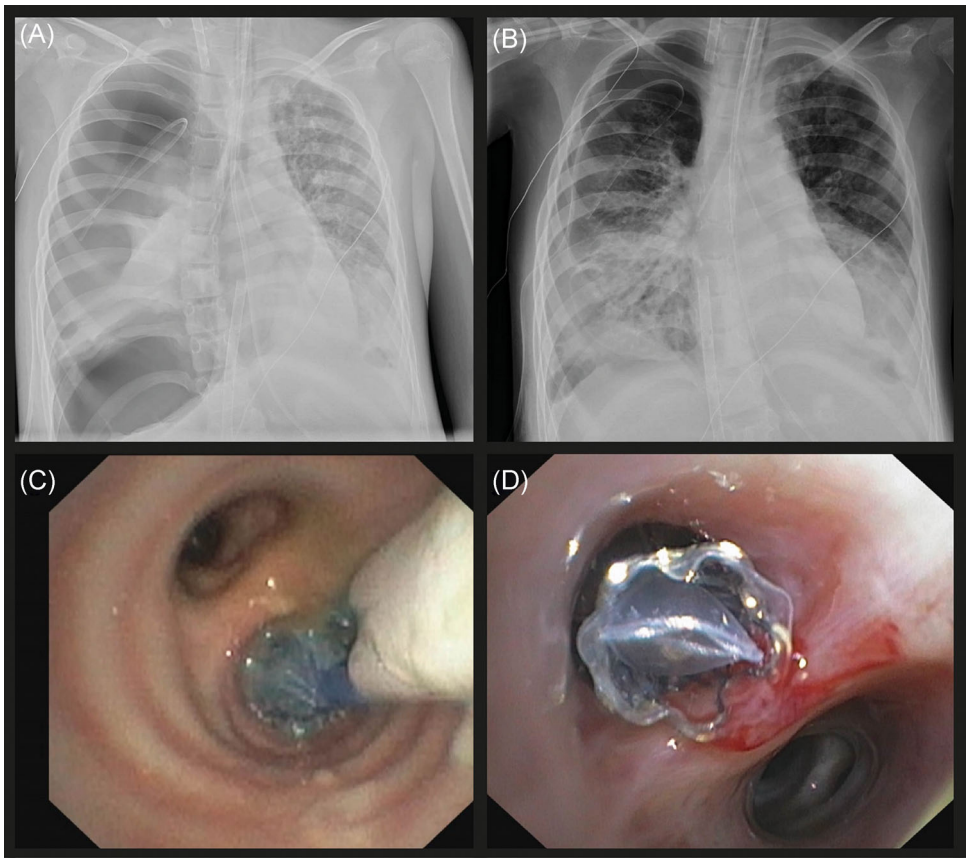

FIGURE 1 A, tension pneumothorax, despite chest tube and EZ-blocker in place. B, expansion of the right lung after placement of the endobronchial valve. C, EZ-blocker with both arms in right main bronchus. D, endobronchial valve in segment 8 [Color figure can be viewed at wileyonlinelibrary.com]

provided through further research and reports on the use of these devices in children.

In conclusion, it was feasible to identify a segmental air leak that could be effectively treated using a one-way EBV in a complicated high-risk pediatric patient on ECLS. EBVs can be considered in the treatment of persistent air leak in children, especially in patients at high-risk for complications or in whom invasive treatment is undesirable or impossible Figure 1.

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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