

Filling in the gaps: Implantable bronchial valves in pediatric patients with persistent leaks

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Abstract

This series presents an adult procedure that benefits young patients with persistent air leaks. This less invasive procedure can be done outpatient with adult/pediatric bronchoscopists providing patients less invasive procedures with better outcomes.

KEY WORDS

air leak, bronchoscopy, interventional bronchoscopy, pediatrics, pneumothorax

Persistent air leak presents an onerous therapeutic challenge in pediatric patients. Many management options are invasive, ranging from surgical resection, chest tube placement to chemical pleurodesis and analogous blood patch pleurodesis.¹ Less invasive measures include surveillance and endoscopic interventions such as implantable endobronchial valve (IBV). All these techniques have been successful in the treatment of persistent air leak in adult patients with underlying lung disease, chest trauma, spontaneous pneumothoraces, or after pulmonary surgery.² We report our single-center series of three pediatric patients, 18 years of age or younger, each having persistent air leak who were referred to our adult interventional pulmonary colleagues for endobronchial valve placement, successfully resolving

the persistent air leak and thereby avoiding major invasive procedures (Table 1).

1 | CASE 1

A 15-year-old boy with stage IV mediastinal germ cell tumor postresection developed persistent air leak secondary to alveolar-pleural fistula. Endoscopic cauterization was attempted however patient required intubation due to bleeding during the procedure. Chest tube remained for 3 weeks until IBV was placed in coordination with the interventional pulmonary service. A size 7-mm valve was placed in the anterior segment of the left upper lobe, the airway suspected to be

Dr Sadia Benzaquen has moved from University of Cincinnati to Albert Einstein Health Network.

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TABLE 1 Characteristics and indications for implantable bronchial valve placement

	Age(years)	Sex	Weight (kg) (at the time of procedure)	Indication for EBV
Case 1	15	Male	56	Alveolar-pleural fistula
Case 2	13	Male	45	Alveolar-pleural fistula
Case 3	18	Male	62	Pneumothorax with persistent air leak

leaking due to its proximity to surgical site (Figure 1). Due to thrombocytopenia, bleeding occurred during the procedure, which was treated with transfusion of platelets and topical epinephrine. Postprocedure, the chest tube was clamped for 1 day, no accumulation of air was visualized on chest radiograph, and the chest tube was removed. IBV was successfully removed 6 weeks later without complications.

2 | CASE 2

A 13-year-old boy with bicuspid aortic valve who developed endocarditis leading to cardiac arrest, extracorporeal membranous oxygenation, and tracheostomy developed recurrent pneumothoraces, pneumomediastinum with decortication. He subsequently developed an alveolar-pleural fistula. The persistent air leak was isolated via bronchoscopy with an endobronchial blocker, with resolution of leak after the inflation of endobronchial blocker in the right mainstem bronchus. Attempts were made to pass the blocker into the right upper lobe however unsuccessful. A fibrin glue placed in the right upper lobe bronchus however did not resolve the leak. The following day, a size 7-mm valve was placed after the leak was isolated to the right middle lobe, with resolution of the leak (Figure 2). Six weeks later, the valve was successfully removed without recurrence of pneumothorax.

3 | CASE 3

An 18-year-old boy with a right lower lobe cystic lung lesion with resection developed right middle lobe persistent air leak despite placement of fibrin glue. Postoperatively, patient still had leak from one of two chest tubes. Interventional pulmonary was able to isolate the leak to the posterior segment of the right upper lobe. The segment was sized with a sizing balloon, with deployment of a size 5-mm valve in the culprit segment (Figure 3). Chest tubes were removed 3 days later with complete resolution of air leak. The valve was removed via bronchoscopy several weeks later without recurrence of the pneumothorax.

4 | DISCUSSION

Implantable bronchial valves are small one way valves that can be placed through a flexible bronchoscope. This procedure can be done as an inpatient or outpatient procedure. Most patients can be discharged home, with removal of the valve in 6-8 weeks. IBV has been used primarily in adult patients with emphysema, traumatic/spontaneous pneumothoraces, alveolar-pleural fistula from lung cancer, or infectious etiology.³ Persistent air leak syndrome provides a unique challenge in the pediatric population. Novel use of implantable bronchial valve in treatment of these air leaks

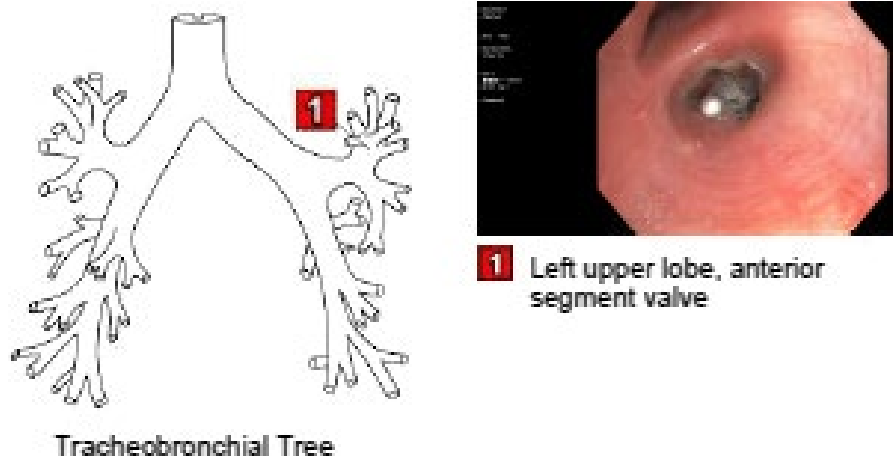


FIGURE 1 Left upper lobe, anterior segment valve

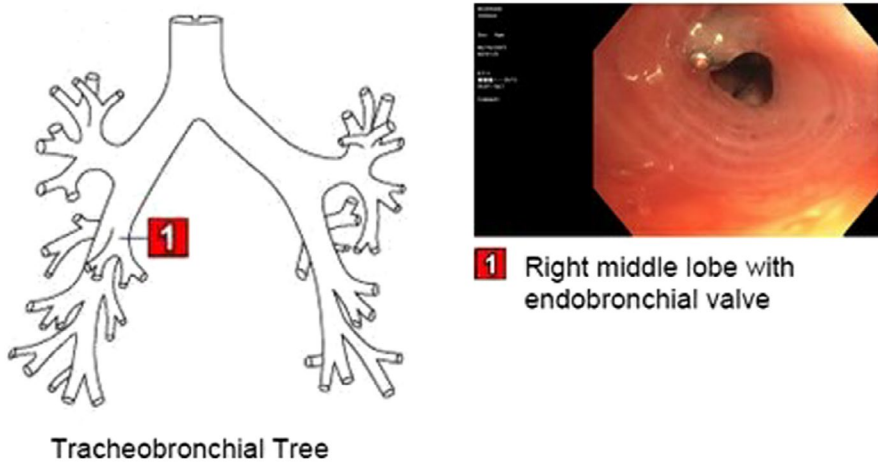


FIGURE 2 Right middle lobe with endobronchial valve

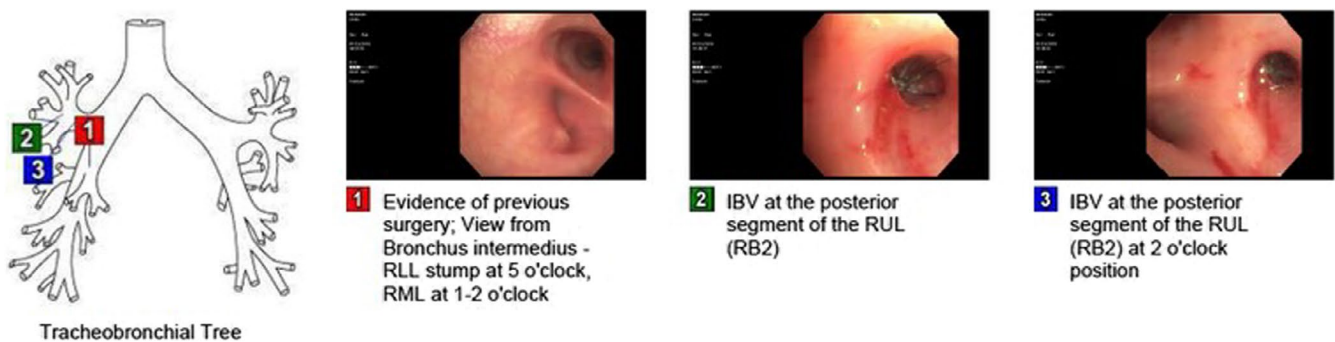


FIGURE 3 Placement of valve in right upper lobe

has only been reported in one single-center trial. A study by Toth et al⁴ described the use of one way valves in their pediatric population. In the aforementioned study, four children were described between the ages of 16 months and 16 years old, with varying etiology of air leaks, including necrotizing pneumonia, postoperative leaks, and pneumatoceles.⁴ Another retrospective study of interventional procedures on pediatrics patients showed success with IBV placement in late teenage population.⁵ Our case series is similar in that, most patients were over the age of 10, mostly male and all

over 40-kg in weight. Like other series, alveolar-pleural fistula was the predominating diagnosis and indication for IBV placement (Table 2). There were very few complications with bleeding being the only complication. The valve was removed between 5 and 7 weeks later, with an average duration of 45 days (Table 2). From this case series, further studies need to be done to develop clear indications for IBV placement in pediatric patients, benefits of such a procedure, risks of doing the procedure, and outcome data. This case series highlights clear benefit with low complication risk.

TABLE 2 Details of procedure including size of valve, days of chest tube, complications, and removal of valve

	Indications for EBV	Type/size of valve	Location of valve	# of days after EBV placement chest tube removed	Complications	Duration before valve removed (days)
Case 1	Alveolar-pleural fistula	7 mm Spiration	Anterior segment of left upper lobe (LB3)	1	Bleeding	36
Case 2	Alveolar-pleural fistula	7 mm Spiration	Right middle lobe bronchus (RB4)	1	None	50
Case 3	Pneumothorax with persistent air leak	5 mm Spiration	Posterior segment of right upper lobe (RB2)	4	None	51

CONFLICT OF INTEREST

None declared.

AUTHOR CONTRIBUTIONS

AOK: is a primary writer of the manuscript, collected the data, edited the manuscript, and submitted the final version of the manuscript. EH: collected the data and edited the manuscript. DS: edited the manuscript and created the images. SB: wrote the manuscript, collected the data, and edited the manuscript.

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How to cite this article: Kuranga AO, Hysinger EB, Caudell Stamper D, Benzaquen S. Filling in the gaps: Implantable bronchial valves in pediatric patients with persistent leaks. *Clin Case Rep.* 2019;7:2410–2413. <https://doi.org/10.1002/ccr3.2490>