inhalation can affect children's health not only in the acute phase such as HDLI but also years after the exposure. Thorough safety evaluation of household chemicals is needed to prevent future chemical-related fatalities and health crises in children. ■

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The LIBERATE Trial: Options to Reduce the Risk of Post-procedural Pneumothorax and Length of Stay

To the Editor:

We read with great interest the recent article by Criner and colleagues of the LIBERATE (Lung Function Improvement after Bronchoscopic Lung Volume Reduction with Pulmonx Endobronchial Valves Used in Treatment of Emphysema) Study Group reporting their results from the first multicenter randomized controlled trial to evaluate the effectiveness and safety of Zephyr endobronchial valves (EBVs) in patients with little or no collateral ventilation out to 12 months (1). Chronic obstructive pulmonary disease represents a significant disease burden worldwide, and patients with advanced emphysema with hyperinflation have limited options apart from lung volume reduction surgery or transplantation (2). EBVs represent a minimally invasive option to achieve similar results in patients with little or no collateral ventilation; however, follow-up studies to date have been short term (limited to 3–6 mo) (3, 4). In this elegant study, Criner and colleagues concluded that Zephyr EBVs provided clinically meaningful benefits in lung function, exercise tolerance, dyspnea, and quality-of-life scores for at least 12 months after implantation.

However, as in previous studies, the authors reported that pneumothorax was the most common and significant serious adverse event during the treatment period, occurring in 44 of 128 patients with EBVs (34.4%) during the 12-month period. Seventy-six percent of these pneumothoraces occurred within 3 days of EBV placement, and 85% occurred within 5 days. This resulted in at least one valve removal in 12 patients, and 38 patients required placement of a chest drain. Eight patients were managed conservatively with observation only. No statistically significant risk factors for pneumothorax occurrence were identified. Of particular concern, three of the four mortalities reported during the treatment period resulted from a pneumothorax at Day 3 in two patients and Day 13 in one patient. Consequently, the authors advised a minimum hospital stay of 3 days after EBV placement, and the optimal post-procedural length of stay could justifiably extend to 5 days.

To address this issue, our group has begun placing a prophylactic chest drain on the side of the implanted EBV at the time of valve placement. We use a 16F chest drain (Thal-Quick Chest Tube Set; Cook Medical Inc.). The drain is placed on a Portex bag (Ambulatory Chest Drainage System; Smiths Medical International Ltd.) and the patient is discharged home with the drain

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Table 1. Summary of Case Series to Date

Patient	Target Lobe	Chartis	StratX Inspiratory Volume (ml)	Drain Removal	Fit for Discharge
1	LLL	No C/V	1,935	Day 6 OPD	Day 1
2	LUL	No C/V	2,199	Day 6 OPD	Day 1
3	LLL	No C/V	1,203	Day 6 I/P	Day 10*
4	LLL	No C/V	2,059	Day 2 I/P	Day 1
5	RUL	No C/V	1,884	Day 7 OPD	Day 1
6	LUL	No C/V	1,963	Day 7 OPD	Day 1
7	LUL	No C/V	1,955	Day 8 OPD	Day 1
8	LUL	No C/V	1,640	Day 8 OPD	Day 1

Definition of abbreviations: C/V = collateral ventilation; I/P = inpatient; LLL = left lower lobe; LUL = left upper lobe; OPD = outpatient department; RUL = right upper lobe.

*Right heart dysfunction/lower respiratory tract infection.

in place. The patient is reviewed in the outpatient clinic 1 week after EBV placement. The drain is then removed if the patient has no evidence of an air leak on clinical examination or pneumothorax radiographically. To date, we have a case series of eight patients with no adverse events (Table 1). This new practice is protective for patients with EBVs given the potential mortality risk with a pneumothorax, and also enables an earlier discharge date than the currently advised minimum of 3 days. We believe that this additional measure may become standard practice from a patient safety perspective to reduce the incidence of clinically significant pneumothoraces with EBV placement and reduce the length of inpatient stays, with associated cost savings. We would recommend wider adoption. ■

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Reply to Fitzmaurice *et al.*

From the Authors:

We appreciate Fitzmaurice and colleagues's acknowledgment of the excellent design, execution, and findings of the LIBERATE (Lung Function Improvement after Bronchoscopic Lung Volume Reduction with Pulmonx Endobronchial Valves Used in Treatment of Emphysema) study, which showed very meaningful benefits of Zephyr valves in patients with severe emphysema (1). Successful occlusion and reduction of target lobar volume allows healthier tissue to expand and better function, and these volume shifts can lead to pneumothorax in some patients. There are various ways to address this reality. Fitzmaurice and colleagues report their limited single-center experience in placing prophylactic chest tubes in all eight patients they treated with Zephyr valves for advanced emphysema. Although 34.4% of the 128 patients treated with Zephyr valves in LIBERATE developed a pneumothorax, not all patients required a chest tube; 17% of those who developed a pneumothorax did not require chest tube placement (1). Subjecting all patients who undergo Zephyr valve placement to chest tube placement may not be advisable, because chest tube placement is not without risks of morbidity and mortality. Chest tube placement has been reported to have early and late complication rates of 3% and 8%, respectively, with complications including pleural and chest wall bleeding, infection, patient discomfort, perforation of major intrathoracic organs, and unintentional intraparenchymal lung placement (2). Additionally, in patients with chronic obstructive pulmonary disease, errant anterior mediastinal placement in a hyperinflated chest has been reported to cause contralateral pneumothorax (3). We have identified and reported patients who are most likely to present with significant challenges should they experience a pneumothorax—specifically, patients in whom the most diseased lobe is not treated and the nontreated contralateral lung destruction score is >60% (1). It may be most appropriate to consider prophylactic placement of a chest tube in these “high-risk” patients, as the benefit-to-risk ratio would be more attractive versus placing one in every patient. Maximizing the benefit-to-risk profile for Zephyr valve treatment begins with proper patient selection, that is, those with little to no collateral ventilation (determined via StratX quantitative computed tomography and/or Chartis), and physician assessment for post-procedure management ranging from prophylactic chest tube placement versus the need for closer observation and duration of hospital stay. Future work and investigation as illustrated by Fitzmaurice and colleagues promise to improve the safety profile and patient benefit of this procedure. ■

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