Babak Mokhlesi, M.D., M.Sc.
Daniela Grimaldi, M.D., Ph.D.
Guglielmo Beccuti, M.D., Ph.D.
Varghese Abraham, M.D.
Harry Whitmore, R.P.S.G.T.
Fanny Delebecque, M.S.
Eve Van Cauter, Ph.D.
University of Chicago
Chicago, Illinois

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Survival after Endobronchial Valve Placement for Emphysema: A 10-Year Follow-up Study

To the Editor:

Bronchoscopic lung volume reduction with endobronchial valves (BLVR) can improve lung function and exercise capacity in appropriately selected patients with emphysema (1–5). Although early data have been encouraging (6), it is not clear whether response to BLVR will translate into sustained survival benefit, as observed after lung volume reduction surgery (LVRS) (7).

Methods

We reviewed the long-term outcome of BLVR in 19 patients with heterogeneous emphysema (Table 1) treated with Emphasys valves, placed to achieve occlusion of a single target lobe, between July 2002 and February 2004 (3, 4, 6). Survival data to November 2015 were compared, using Kaplan-Meier analysis, between those with (n = 5) and those without (n = 14) evidence of atelectasis on thoracic computed tomography scan performed 1 month postprocedure.

Results

In the atelectasis group, two of five patients (40%) were still alive compared with 2 of 14 (14%) of the nonatelectasis group ($P = 0.017$) (Figure 1).

Discussion

These data suggest that successful BLVR may be associated with a substantial, persisting survival benefit similar to that observed after LVRS. The most likely explanation for the occurrence of atelectasis in some, but not other, patients is the absence or presence of collateral ventilation between the target lobe and adjacent lung because of disruption of the interlobar fissures by emphysema. Patients in whom collateral ventilation is thought to be present (either measured directly or assessed using analysis of interlobar fissures on computed tomography scans) are not now recommended for BLVR. A second issue is a technical one around valve placement and airway anatomy. Sometimes it is difficult to achieve a satisfactory seal, and valves may need to have their placement adjusted. Overall, the response rate was similar to that observed in other trials in which patients were not selected on the basis of collateral ventilation (5).

Although it is possible that the difference in survival could be explained by some disparity in the baseline characteristics of the two groups other than collateral ventilation, this seems unlikely. The groups were well matched (Table 1), including for gas transfer, the lung function parameter most strongly associated with survival

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Table 1. Baseline Characteristics

	All (*N* = *19*)	Nonatelectasis (*n* = *14*)	Atelectasis (*n* = *5*)	*t* Test
Age, yr	58.7 (8.7)	59.6 (9.0)	56.0 (7.6)	0.4
Female, %	16	14	20	0.7
BMI, kg · m^{-2}	23.3 (4.1)	21.6 (2.9)	28.2 (2.9)	0.004
FFMI	16.1 (1.6)	15.8 (1.5)	17.5 (1.4)	0.05
SGRQ symptoms	63.7 (19.2)	63.3 (18.2)	64.9 (24.3)	0.9
SGRQ activity	78.5 (16.5)	76.9 (18.1)	83.2 (11.0)	0.5
SGRQ impacts	45.1 (13.5)	42.8 (13.9)	51.9 (11.0)	0.2
SGRQ total	58.4 (12.8)	56.5 (14.2)	63.5 (2.3)	0.3
FEV_1% pred	28.4 (11.9)	28.6 (11.8)	27.7 (13.3)	0.9
FVC, % pred	80.3 (22.4)	80.1 (18.2)	81.0 (34.3)	0.9
TLC, % pred	139.3 (15.6)	141.1 (16.0)	134.3 (14.7)	0.4
RV, % pred	260.5 (68.4)	264.4 (66.6)	249.4 (80.0)	0.7
RV/TLC	63.2 (12.0)	64.0 (10.8)	60.9 (16.1)	0.6
FRC, % pred	208.9 (38.9)	213.3 (37.9)	200.1 (44.1)	0.5
D_{LCO}, % pred	35.9 (10.9)	35.6 (11.2)	36.9 (11.1)	0.8
Pa_{CO_2}	4.8 (0.6)	4.8 (0.5)	4.8 (0.8)	0.9
Pa_{O_2}	9.8 (1.5)	10.0 (1.4)	9.2 (1.7)	0.3
Exacerbation rate/yr	2.2 (1.9)	1.9 (1.5)	2.8 (2.7)	0.4
Peak workload, W	48.9 (18.0)	50.4 (20.0)	40 (11.8)	0.6
$\dot{V}O_2$, L/min	0.84 (0.22)	0.85 (0.23)	0.85 (0.26)	0.99
$\dot{V}CO_2$, L/min	0.78 (0.21)	0.79 (0.27)	0.79 (0.23)	0.98
$\dot{V}E$, L/min	29.7 (8.1)	29.5 (9.9)	29.5 (4.1)	0.99

Definition of abbreviations: BMI = body mass index; D_{LCO} = diffusing capacity of the lung for carbon monoxide; FFMI = fat-free mass index; FRC = functional residual capacity; pred = predicted; SGRQ = St. George's Respiratory Questionnaire; RV = residual volume; TLC = total lung capacity. Values are mean (SD). Exercise parameters are values obtained during symptom-limited incremental cycle ergometry.

in chronic obstructive pulmonary disease (8), as well as for cardiopulmonary exercise parameters and exacerbation history.

The absence of a control group is, of course, a limitation for the interpretation of these data, but they do nevertheless support the idea that BLVR, similar to LVRS, can improve the natural history of chronic obstructive pulmonary disease and support equipoise between the procedures. The indications for endobronchial valves and LVRS overlap considerably: heterogeneous emphysema with an appropriate target area and hyperinflation and gas trapping in patients who are not too frail to be able to cope safely with the intervention or are outside the lung function safety criteria (9). Direct comparison studies of adequate duration are now needed

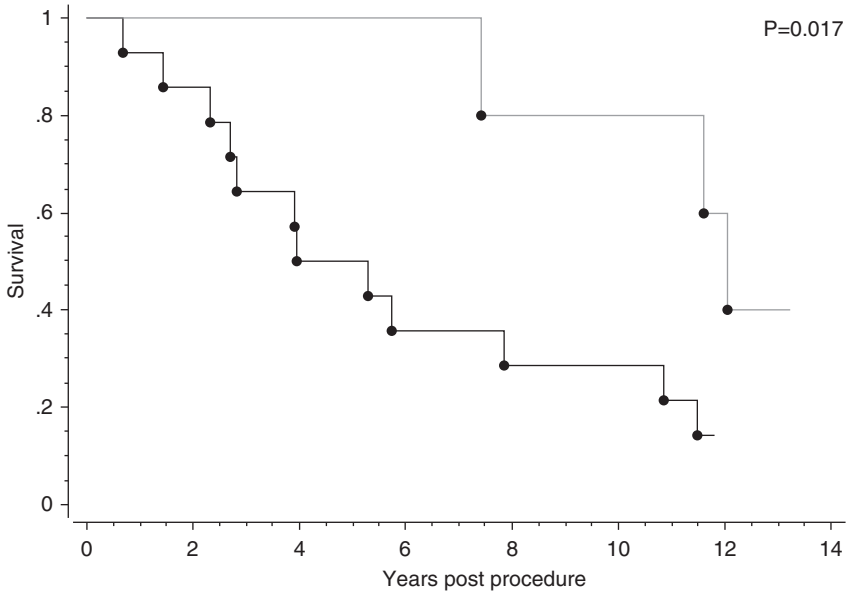

Figure 1. Prolonged transplant-free survival in which atelectasis occurs after bronchoscopic lung volume reduction with endobronchial valves. The *upper line* shows significantly improved survival in patients (n = 5) in whom radiological atelectasis occurred after endobronchial valve placement occurred compared with the *lower line* (n = 14), for which atelectasis did not occur ($P = 0.017$).

to compare outcomes between these two treatment modalities so that clinicians and patients can make informed choices about whether to proceed with a bronchoscopic or surgical approach. ■

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Justin Garner, M.B. B.S.
Samuel V. Kemp, M.D.
National Institute for Health Research Respiratory Biomedical Research Unit at Royal Brompton and Harefield National Health Service Foundation Trust and Imperial College London
London, United Kingdom

Tudor P. Toma, Ph.D.
Lewisham and Greenwich National Health Service Trust
London, United Kingdom

David M. Hansell, M.D.
Michael I. Polkey, Ph.D.
Pallav L. Shah, M.D.
Nicolas S. Hopkinson, Ph.D.
National Institute for Health Research Respiratory Biomedical Research Unit at Royal Brompton and Harefield National Health Service Foundation Trust and Imperial College London
London, United Kingdom

ORCID ID: 0000-0003-3235-0454 (N.S.H.).

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It Is Too Early to Say No Place for High-Frequency Oscillatory Ventilation in Children with Respiratory Failure

To the Editor:

In their article on early high-frequency oscillatory ventilation in pediatric acute respiratory failure, Bateman and colleagues (1) reported that early use of high-frequency oscillatory ventilation (HFOV) was associated with a longer duration of mechanical ventilation. I am concerned that using propensity score to compare early and late use of HFOV is not equal in terms of severity, which will lead to misleading interpretations of the study result. If we look at the Pediatric Risk of Mortality score in two groups, there was a significant difference at baseline (11.5 vs. 7; $P < 0.001$). In addition, there was a greater prevalence of patients with cancer in the early HFOV group compared with in the conventional mechanical ventilation (CMV)/late HFOV group (17% vs. 7%; $P < 0.001$) This might lead to worse outcome in the early HFOV group, even though the degree of hypoxia was comparable at the beginning. I and colleagues have also published a few studies related to the use of HFOV, including a recent randomized controlled trial comparing HFOV and CMV with lung volume recruitment (2, 3). We actually showed the benefit of HFOV above CMV, especially with regard to oxygenation response. We did not find a significant difference in mortality because of our small sample size.

In my experience, HFOV would most benefit children with no underlying disease who suffer with severe oxygenation failure (oxygenation index >15, not >8). As mentioned in the accompanying editorial (4), the dramatically worse oxygenation index and organ dysfunction in patients receiving early HFOV appeared to persist afterward. Moreover, there may still be concerns that other unmeasured factors such as patients' clinical status or physician practice pattern could lead to clinical deterioration in early use of HFOV. ■

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Rujipat Samransamruajkit, M.D.
Chulalongkorn University
Bangkok, Thailand

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