reduction in dyspnea after LVRS in emphysema is asserted by other metucilus studies. The studies indicate the improvement in dyspnea may be related to the improved elastic recoil and the decreased functional residual capacity, which may increase the diaphragm fiber length that allows the diaphragm to generate more pressure for a given neural output. Further, it is possible that the LVRS may affect the airway tissue resistance, which is related to the mechanical interdependence between airways and parenchyma. Because the interdependence is considerably affected by lung volume, the volume reduction of the hyperinflated lung (i.e., decreased total lung capacity) may increase airway resistance, and decrease the interdependence, resulting in the improvement of the expiratory flow, such as FEV\(_1\).

Taken together, it is not yet clear which of the many measurements of lung function are those that correlate with symptomatic improvement and should be monitored after LVRS. Therefore, further long-term studies are required to determine the efficacy of this attractive procedure for diffuse emphysema in terms of lung function and symptoms.

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Predicted Postoperative FEV\(_1\), and Complications in Lung Resection Candidates

To the Editor:

We read with interest the results of Kearney et al (March 1994) and found that in a multivariate analysis, predicted postoperative FEV\(_1\) (PPOFEV\(_1\)) was the only independent predictor of postoperative complications (30% morbidity rate), as it was in our most recent 250 consecutive patients undergoing lung resection (56 pneumonectomies, 160 lobectomies, 34 wedge resections). We also applied the model of mathematical calculation of PPOFEV\(_1\), which we expressed as percentage of predicted value for age, sex, and body surface area, since we consider absolute values inappropriate for accurate clinical evaluation.

When the tumor is endobronchial or hilar, it may cause atelectasis and ventilation/perfusion mismatch. With the aid of CT scan and bronchoscopy, we estimated and excluded the nonfunctioning segments of the diseased lung from the calculation.

Seventy percent of our patients with a PPOFEV\(_1\) <35% of predicted value showed postoperative complications. The mean value (32.5%) was significantly lower (p<0.05, Student’s t test) than that in the whole group of patients with complications (60.9%), supporting the cutoff value of 40% suggested by others
(even though quantitative perfusion scan was not used in our study) and indicating also a good correlation between these two different methods.

Kearney et al concluded that although PPOFEV\(_1\) < 1 L was significantly associated with postoperative complications, the magnitude of risk was limited (33% morbidity rate in this group of patients). This led them to the assumption that patients with significant ventilatory impairment can undergo lung resection with low morbidity and mortality rates. We think that the definition of ventilatory impairment made on the basis of absolute values of PPOFEV\(_1\) is imprecise. Moreover, their results are flawed because of the high number of wedge resections (38% of the total procedures) and the extremely healthy population (Karnofsky index of 9.1, limiting dyspnea in 5%). The results are probably overestimated because of the lack of correction in the calculation of PPOFEV\(_1\) in cases of unequal distribution of ventilation and perfusion.

Nevertheless, we concur with Kearney et al that surgery need not be denied on the basis of a low PPOFEV\(_1\). Cutoff values indicate the need for further examination (exercise testing) rather than inoperability.

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Assessment of Oxygen Uptake During the Six-Minute Walk Test in Patients With Heart Failure

To the Editor:

We read with interest the recent article by Cahalin and colleagues (August 1996) on the 6-min walk test (6WT) in patients with heart failure. Compared to conventional symptom-limited exercise testing, the 6WT is usually better accepted by heart failure patients since it mimicks daily activities and is well tolerated. Furthermore, this test is easy to perform and does not require an expensive apparatus for respiratory gas analysis.

We would like to report our recent experience with a group of 26 patients with moderate to severe heart failure due to left ventricular systolic dysfunction in whom exercise tolerance was evaluated both by oxygen uptake (VO₂) at peak of symptom-limited cardiopulmonary exercise test on an upright bicycle and by distance walked during a 6WT. In addition, during the 6WT VO₂ and carbon dioxide production were measured using a recently validated (unpublished data; University of Freiburg; Freiburg, Germany; April, 1995) portable device (Cortex-Metamax, Leipzig, Germany). Of interest, we found a correlation (r = 0.63) between distance walked during the 6WT and peak VO₂ during the maximal exercise testing which was very similar to that reported by Cahalin et al (r = 0.64). Furthermore, three of four patients who walked 300 m or less were admitted to the hospital in the following few months because of clinical deterioration, and one patient died of progressive heart failure. On the other hand, only three of the remaining 22 patients walking more than 300 m were hospitalized for severe heart failure in the same period (distance walked was 340, 372, and 466 m, respectively). Thus, although our study population was small, our data seem to support the results of Cahalin et al indicating that a reduction of distance walked during the 6WT may identify those patients with a worse prognosis in the short term.

Another point of interest of our study, in our opinion, was the finding that the VO₂ at the end of 6WT was, on average, only 15% lower than that measured at the peak of symptom-limited exercise (12.9 ± 4.4 and 15 ± 4 mL/kg/min, respectively); furthermore, in seven of 26 patients (27%) the 6WT VO₂ was equal or even higher than peak exercise VO₂. In addition, anaerobic threshold was identified in 19 patients during the 6WT and in 23 patients during maximal exercise; VO₂ at anaerobic threshold was similar in the two tests (11.9 ± 4.2 and 12.2 ± 3.5 mL/kg/min). According to these results, in at least one fourth of heart failure patients, the distance walked during 6WT, usually considered an index of submaximal exercise capacity, probably better reflects maximal exercise tolerance. Furthermore, in most patients, the energy expenditure required during the 6WT seems supported, at least in part, by anaerobic metabolism (work above the anaerobic threshold).

Obviously, the data we report need to be verified in larger study populations, since, to the best of our knowledge, there is only one published paper reporting the measurement of VO₂ during the 6WT in a small group of heart failure patients. We think that these results, if confirmed, should be considered when interpreting the information obtained from the 6WT in these patients. Finally, it remains to be determined whether respiratory gas analysis during 6WT, performed by means of a portable device system, adds insights which can be useful for the functional evaluation of heart failure patients, compared to the measurement of distance walked alone.

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References

Defining Patients’ Abnormal Pulmonary Function

To the Editor:

Lefante and colleagues (August 1996) are to be commended for demonstrating the correlation between FEV₁/FVC and FVC expressed as a percentage of the predicted value (FVC%PRED) in 656 working men with reduced values of FEV₁/FVC. The lower the FEV₁/FVC, the lower was the FVC%PRED.

The decrease in FVC in patients with airflow obstruction due to COPD (and the even greater decrease in FVC in some patients with asthma) has been documented previously. Also, Robert Garrett and I proposed a graph of FVC%PRED vs FEV₁/FVC% (that is, FEV₁/FVC*100), which stresses the importance of this relationship in the interpretation of spirometry.

However, a confidence band of FVC%PRED vs FEV₁/FVC% is needed, particularly for patients known to have COPD, in order to distinguish between obstructive defects and combined obstructive and restrictive defects. The authors’ data can provide such a boundary line (although the cause of their subjects’ airflow obstruction is not defined). How much can FVC be reduced solely by airflow obstruction due to COPD? I have used the following rule of thumb: if FVC%PRED is less than FEV₁/FVC%, the reduction in FVC is too great to be ex-

Figure 1. A rule-of-thumb lower limit line (dashed line; FVC%PRED=100*FEV₁/FVC) plotted on the graph of Lefante and coworkers.

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