Physician Estimation of FEV₁ in Acute Exacerbation of COPD*

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There have been recent recommendations to include objective measurements of airway obstruction in the treatment of patients with acute asthma. These recommendations are based in part on the inaccuracy of physicians in estimating airways obstruction in asthmatic patients. The purpose of this study was to evaluate the ability of physicians to estimate the degree of airways obstruction in patients with acute exacerbation of COPD. We studied 90 patients. The physicians were able to estimate the percent of predicted normal FEV₁ to within 10 points only 38 percent of the time prior to treatment and 46 percent of the time posttreatment.

Forty-nine percent of the patients whom the physicians believed had an improvement in pulmonary function with treatment actually did not improve, while 31 percent of the patients who the physicians believed did not improve their pulmonary function with treatment actually did improve. We conclude that physicians' estimates of the degree of airway obstruction in acute exacerbation of COPD are inaccurate. Assessment of patients in the emergency department presenting with COPD should be based on objective measurements of pulmonary function.

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METHODS

This study was conducted in the Emergency Department of MetroHealth Medical Center, a county-owned, urban hospital. Patients older than 50 years of age with an acute exacerbation of COPD, as defined by published criteria, were included in the study. All patients enrolled in the study had a diagnosis of COPD previously established by their primary care physician. This was confirmed by reviewing the medical record for documentation of emphysema, chronic bronchitis, or chronic airflow limitation. Patients with acute asthma, congestive heart failure, pneumonia, or pneumothorax were excluded from this study, as were patients with lung cancer. On initial evaluation, the treating physician (either an emergency medicine attending physician or a postgraduate second year medical resident) estimated the percent of predicted normal value for the FEV₁. Pulmonary function testing was then performed, prior to treatment, using a computerized, portable, pneumotachygraph-type spirometer (Fleisch, SpiroScan 1000, Brentwood Instruments). The spirometer was calibrated at least three times per week using a 3-L syringe. Spirometry was obtained with the patient seated and wearing noseclips. At least two, and usually three, forced expiratory curves were obtained. The spiromograms were reviewed to ensure that they met established criteria. The largest FEV₁ was used for analysis. The treating physicians were not blinded to the results of the pretreatment FEV₁ before obtaining the posttreatment FEV₁.

Patients were treated with hourly administration of inhaled β-agonists. Patients received aminophylline or intravenous steroids at the discretion of the treating physician. An estimation of FEV₁ was again made at the time that the treating physician made a clinical decision for admission to the hospital or discharge from the emergency department. Spirometry was then repeated as described above. This study was approved by the hospital's Human Investigation Committee.

Categorical variables were evaluated using the χ² test. A p value <0.05 was taken to indicate statistical significance. Continuous variables are reported as the mean ± standard deviation. Unless otherwise noted, FEV₁ is reported as the percent of predicted normal value. For the purposes of this study, an estimate was deemed accurate if the absolute difference between the estimate of the percent of predicted normal FEV₁ and the actual percent of predicted normal FEV₁ was less than 10 percent.

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RESULTS

Ninety patients (46 men and 44 women; average age, 63.0 ± 8.5 years) were enrolled in the study. The patients reported an average of 51.9 ± 23.8 pack-years of cigarette smoking. Seventy-nine percent of the patients were using a β-agonist inhaler, 32 percent of the patients were taking steroids on an outpatient basis, and 75 percent of the patients were taking theophylline products.

The pretreatment FEV₁ was 30.9 ± 18.9 percent. There was a correlation of 0.42 between the pretreatment FEV₁ and the physician’s estimate of FEV₁ (p<0.001; Fig 1). Thirty-eight percent of the physician’s pretreatment estimates were accurate, 48 percent of estimates were high, while 14 percent of estimates were low. The posttreatment FEV₁ was 35.7 ± 19.7 percent. The correlation between posttreatment FEV₁ and physician estimate was 0.63 (p<0.0001; Fig 2). Forty-six percent of the physicians estimates of posttreatment FEV₁ were accurate, 43 percent of estimates were high, while 11 percent were low. Thirty-one percent of the physicians whose initial estimates were inaccurate had a posttreatment estimate that was accurate, while only 11 percent of physicians whose pretreatment estimates were accurate had inaccurate posttreatment estimates (p<0.001).
Forty-three percent of the patients had an improvement in pulmonary function of at least 20 percent following treatment. Forty-nine percent of patients in whom the physicians believed had an improvement in FEV$_1$, did not have an improvement in FEV$_1$, while 31 percent of patients who the physicians believed did not have an improvement in pulmonary function actually had an improvement in pulmonary function. Fifty-four patients (60 percent) were evaluated by a medical resident while 36 (40 percent) were evaluated by an emergency medicine attending physician. Sixty-one percent of the attending physicians' pretreatment estimates were accurate while only 22 percent of the residents' estimates were accurate (p<0.001). Posttreatment, 40 percent of the residents' estimates were accurate while 54 percent of the attending physicians' estimates were accurate (NS). We further evaluated the physician's ability to evaluate pulmonary function in patients with severe impairment (FEV$_1$<30 percent). In this subset of patients, 36 percent of physicians' pretreatment estimates were accurate while 42 percent of posttreatment estimates were accurate.

**DISCUSSION**

This study demonstrates that physicians are unable to accurately estimate airway obstruction in patients with acute exacerbation of COPD. As is demonstrated by Figures 1 and 2, most estimates are high. The effect of this overestimation may be inappropriate decision-making by physicians relying on clinical evaluation alone. The finding that physicians are poor at estimating pulmonary function is consistent with the results of a previous study in patients with stable asthma. In that study, 6 pulmonologists attempted to estimate the peak expiratory flow rate in 17 patients on 62 occasions. While there was a correlation of 0.66 between the estimates and the actual value, in fact, only 44 percent of the estimates were within 20 percent of the actual peak expiratory flow rate. In that same study, however, patients estimated their peak expiratory flow rate to within 20 percent of measured value 63 percent of the time. There appear to be no similar data assessing the ability of physicians to estimate pulmonary function during the acute asthma attack.

A number of studies have demonstrated the limited relationship between clinical signs and symptoms and the degree of airway obstruction. McFadden et al found that signs of airway obstruction remit following acute attacks even though FEV$_1$ remains around 50 percent of predicted value, while clinical symptoms disappear with an FEV$_1$ of around 63 percent of predicted normal. Kelsen et al found that approximately 10 percent of patients who were believed to have clinical improvement following treatment for acute asthma, in fact, did not demonstrate any improvement in FEV$_1$. Further, clinical signs of severe airway obstruction such as sternocleidomastoid retraction and pulsus paradoxicus were present in only 48 percent of patients with an FEV$_1$ less than 1 L. Shim and Williams found that there is an association between the presence and character of wheezing and the peak expiratory flow rate, although there were significant overlaps in the patients with and without severe airway obstruction. Similarly, Baumann et al investigated the relationship between wheezing and the decrease in FEV$_1$ following bronchial challenge. Fewer than half of the patients demonstrated wheezing in spite of the fact that the FEV$_1$ fell by approximately 30 percent. In that study, there appeared to be no statistically significant relationship between wheezing and the change in either FEV$_1$ or peak expiratory flow rate. There were also no differences in the drop in FEV$_1$ between the patients who complained of dyspnea and those who denied dyspnea following the challenge test. Similarly, Re buck and Read found that there was considerable overlap between patients who had apparently severe asthma based on clinical presentation and those who, in fact, had significant airway obstruction as measured by FEV$_1$.

Determination of the degree of airway obstruction, either by actual measurement or by estimation based on clinical presentation, is important because of the relationships among pulmonary function, arterial blood gas abnormalities, and the need for hospitalization. Several studies have demonstrated that hypoxemia and hypercarbia occur in acute asthma when pulmonary function falls below 24 to 40 percent of predicted normal. In acute exacerbation of COPD, although pulmonary function does not predict hypoxemia, it does identify patients at risk for hypercarbia. Similarly, studies have found that pulmonary function predicts the need for hospitalization both in asthmatics and in patients with acute exacerbation of COPD.

Although this study confirms that physicians cannot reliably estimate the degree of airway obstruction, this study does not provide evidence that physicians would use the results of spirometry appropriately in clinical decision-making. We have found that the posttreatment estimates of pulmonary function were somewhat better than the pretreatment estimates of pulmonary function, particularly for the resident physicians. This suggests that knowledge of the patient's initial pulmonary function may have aided the physician's ability to estimate the degree of airway obstruction posttreatment. Although this knowledge of the pretreatment FEV$_1$ introduces some bias into the study, it also provides information about the need for both pretreatment and posttreatment.
ment spirometric testing. We have found that attending physicians in a teaching hospital perform better than residents at assessing pulmonary function. The accuracy of physicians in other settings, particularly those who do not routinely use pulmonary function testing, may be different. Many of our attending physicians’ estimates also were inaccurate, suggesting that good clinical assessment cannot substitute for objective measurement of pulmonary function. Within these limitations, we conclude that clinical evaluation is an imperfect means of assessing airway obstruction and recommend that objective measurement of pulmonary function be obtained in patients with acute exacerbation of COPD.

CONCLUSIONS

Physicians estimated the FEV₁ in 90 patients with acute exacerbation of COPD. Only 38 percent of pretreatment estimates and 46 percent of posttreatment estimates were accurate. Physicians were able to identify whether pulmonary function improved 52 percent of the time. Inexperienced house officers performed worse than attending physicians, suggesting that the use of pulmonary function testing should be incorporated into training programs. We conclude that assessment of patients with acute exacerbation of COPD should include objective measurement of pulmonary function.

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