Prevalence of Depression and Anxiety in Patients with COPD*

Relationship to Functional Capacity

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The objective of this study was twofold: (1) to document the prevalence of depression and anxiety in patients with moderate or severe chronic obstructive pulmonary disease; and (2) to determine whether the presence of depression or anxiety adversely affected the functional capabilities of the patient as reflected by the distance he could walk in 12 minutes. Forty-five patients with an FEV₁ < 1.250 ml underwent pulmonary function testing including spirometry, single breath diffusing capacity, and arterial blood gas determinations. The degree of depression was assessed by the Beck depression inventory, while the degree of anxiety was assessed by the State-Trait anxiety inventory. Forty-two percent of the patients had significant depression, while only 2 percent of the patients had significant anxiety. There was a highly significant correlation between the depression scores and the anxiety scores (r = 0.81, p < 0.001). There was no significant correlation between the level of depression or anxiety and the distance that the patient could walk in 12 minutes. From this study, we conclude that the prevalence of depression in patients with moderate or severe COPD approaches 50 percent while the incidence of anxiety is much lower (2 percent).

Previous reports have suggested that there is a high prevalence of depression and/or anxiety in patients with chronic obstructive pulmonary disease (COPD). However, most of the referenced studies had a relatively small sample size, used questionable instruments with which to assess the prevalence of depression and/or anxiety, and most contained no formal data analysis. A recent study by McSweeney et al had none of these shortcomings. This latter study included only patients with severe hypoxemia (PaO₂ < 60 mm Hg). Since most of the patients in this latter study had neuropsychologic dysfunction as well as severe hypoxemia, it is unclear whether the results of it can be extrapolated to the general population with COPD. Accordingly, the first objective of the present study was to assess the prevalence of depression and anxiety in a population of patients with moderate-to-severe COPD.

It is known that there is a relatively poor correlation (r = 0.60) between the exercise tolerance of a patient and any measure of pulmonary function. This indicates that less than 40 percent of the variance in the exercise tolerance can be explained by its dependence on the level of pulmonary function. It has been suggested that the presence of anxiety or depression in a patient with COPD adversely affects his functional capabilities when the degree of physiologic derangement is taken into consideration. Therefore, the second objective of the present study was to ascertain if there was a significant relationship between the functional capability of the patient and his level of depression or anxiety when the degree of pulmonary dysfunction was taken into consideration.

Material and Methods

Patient Population

The participants in the study were recruited from the outpatient pulmonary clinic at the Veterans Administration Medical Center, Long Beach, California. To be considered as a candidate for participation in this study, the forced expiratory volume in one second (FEV₁) of the patient was required to be below 1,250 ml and the ratio of the FEV₁ to the forced vital capacity (FVC) was required to be less than 50 percent. In addition, the patient had to be between 40 and 70 years old and with his exercise tolerance limited by shortness of breath. Patients were excluded who had received tricyclic antidepressants or other major antipsychotic drugs within the previous two months. Also excluded were patients who had other significant complicating diseases such as uncontrolled malignancy, hepatic insufficiency, insulin-dependent diabetes mellitus, anemia, myocardial infarction within the previous year, cardiac arrhythmias, neuromuscular disease limiting ambulation, or blindness.

Study Protocol

All patients attending the outpatient pulmonary clinic between July 1, 1983, and October 1, 1983 who met the inclusion criteria were interviewed and given the opportunity to participate in the project. Seventy-seven patients met the inclusion criteria and were interviewed concerning their possible participation in the study. At this initial interview, two of the patients manifested severe psychologic problems and were referred to the Psychology Service. Of the remaining 75 patients, 45 (60 percent) agreed to participate in the study and signed informed consent forms approved by the Human Studies Committee at our institution. The most common excuse given for nonparticipation was a dislike for psychologic testing and anything else to do with psychiatrists. The second most common

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excuse was that transportation was too difficult, while the next most common excuse was that the study would interfere with the work schedule of the patient.

After the written informed consent was obtained, the patient was scheduled on a subsequent day for pulmonary function testing and psychologic testing. First, spirometry was performed with a rolling seal spirometer. For the spirometric measurements (FEV₁, FVC, FEV₁/FVC), each patient performed at least three forced expiratory maneuvers in the sitting position. The spirometry was deemed acceptable only when the FEV₁ and the FVC from the best two efforts were within 5 percent. The best value recorded for the FEV₁ and the FVC was used for statistical analysis. The diffusing capacity of the lung for carbon monoxide (D\textsubscript{CO}) was measured by the single breath technique. The predicted values of Cotes and Hall\textsuperscript{a} were used. Subsequently, arterial blood was obtained for analysis with the patient at rest in a sitting position.

The functional capability of the patient was then assessed with a 12-minute walk.\textsuperscript{11,12} The patient was told to walk at a pace that he could maintain for the entire 12 minutes and that the purpose of the walk was to determine the maximal distance that he could walk in 12 minutes. This test was performed in a carefully measured air-conditioned corridor. The technician did not walk with the patient; however, the patient was always visible to the technician.

After the patient completed the 12-minute walk, his level of depression was assessed by the Beck Depression Inventory.\textsuperscript{13} This instrument consists of 21 groups of statements each with four possible responses. The patient is asked to select the one statement from each group that best describes the way he has been feeling the past week. Each answer is scored on a scale of zero to three. A patient with a total score of 15 or above is considered to have significant depression.\textsuperscript{12}

The presence of anxiety was assessed with the State-Trait Anxiety Inventory developed by Spielberger et al.\textsuperscript{14} This examination consists of 40 multiple choice questions. Twenty questions pertain to how the patient feels on that particular day (State) while the remaining 20 questions deal with how the patient generally feels (Trait). Each answer is scored on a scale of one to four. The raw scores are then normalized. The mean normalized score for the general medical population is 50.0 with a standard deviation of 10.0.\textsuperscript{19}

Statistical Analysis

Simple and multiple regression analysis was used to assess the relationship between the various test results. To analyze the influence of depression or anxiety on the 12-minute walking distance, regression analysis was performed using the distance walked in 12 minutes as the dependent variable and the depression score, anxiety score, pulmonary function test results, and arterial blood gas analysis results as the independent variables.

RESULTS

The demographic characteristics of the 45 patients who completed the study are summarized in Table 1.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Actual Value</th>
<th>% Predicted</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>62.4</td>
<td>4.3</td>
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<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>12 Min Walk (ft)</td>
<td>1635</td>
<td>708</td>
</tr>
</tbody>
</table>

All patients were men. Thirty-five of the 45 patients had severe COPD as defined as an FEV₁ less than 1,000 ml and/or an FEV₁/FVC less than 0.40. The participants in the study had a substantial amount of emphysema since their mean D\textsubscript{CO} was less than 50 percent. The mean PaO\textsubscript{2} was below normal, but only four of the patients (9 percent) had a PaO\textsubscript{2} below 60 mm Hg. The mean PaCO\textsubscript{2} was within normal limits and only two patients (4 percent) had a PaCO\textsubscript{2} above 45 mm Hg. The average patient in the study could walk only 1,635 feet in the 12 minutes.

There was a high prevalence of depression in this study population. Nineteen of the 45 patients (42 percent) had depression scores above 15, which indicates significant depression. The mean score for the entire population was 15.0. In order to elucidate the reason for the depression, the depression scores were correlated with the various tests of pulmonary function. The only significant correlation was the correlation between the diffusing capacity and the depression score (r = 0.33, p<0.05). Other correlation coefficients were as follows: FEV₁ (r = 0.004), FVC (r = -0.11), FEV₁/FVC (r = 0.08), PaCO\textsubscript{2} (r = -0.11), PaO\textsubscript{2} (r = -0.01), and age (r = 0.22), all p>0.05.

Although there was a high prevalence of depression, anxiety was not prevalent in this population. Only one of the study patients had moderate anxiety, which was defined as an anxiety score more than two standard deviations above the mean for the medical patient population. Six of the patients had mild anxiety, which was defined as an anxiety score between one and two standard deviations above the mean. The mean anxiety scores of the patients studied were 51.5 for the trait score and 49.5 for the state score. These scores are not significantly different from those of the general medical population (mean = 50.0). The level of anxiety did not correlate significantly with any measure of pulmonary function.

There was a close relationship between the anxiety scores and the depression scores in this group of 45 patients (r = 0.81, p<0.0001 for the trait score; r = 0.71, p<0.0001 for the state score). All seven patients with mild or moderate anxiety had depression scores of 15 or above. It therefore appears that depression and anxiety tend to occur together in patients with severe COPD, but that the degree of depression is worse than is the degree of anxiety.

The distance that a patient was able to walk in 12 minutes was not related significantly to either his level of depression or to his level of anxiety. The correlation coefficient between the 12-minute walking distance and the depression score was only −0.08 (NS), while the correlation coefficient between the 12-minute walking distance and the anxiety score was only −0.01 (NS). Even when multiple regression analysis was
performed using the 12-minute walking distance as the dependent variable and the depression or anxiety score and various combinations of the pulmonary function test results as the independent variables, there was never a significant reduction in the variance when either the depression score or the anxiety score was added to the analysis.

The correlation coefficient between the distance walked in 12 minutes and the various pulmonary function test results are shown in Table 2. The highest correlation was between the 12-minute walking distance and the FEV1/wt (r = 0.38). The correlation coefficient of 0.38 indicates that only 15 percent of the variance in the 12-minute walking distance could be explained by its dependence on the FEV1/wt. When multiple regression analysis was performed, the multiple regression coefficient never exceeded 0.40. In none of the analyses was the variance significantly reduced when any variable was added in addition to the FEV1/wt.

**Table 2—Correlation Coefficients Between 12-Minute Walking Distance and Various Measures of Pulmonary Function**

<table>
<thead>
<tr>
<th>Test</th>
<th>r value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEV1/wt</td>
<td>0.39</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>FVC</td>
<td>0.35</td>
<td>&lt;0.025</td>
</tr>
<tr>
<td>FVC/WT</td>
<td>0.34</td>
<td>&lt;0.025</td>
</tr>
<tr>
<td>FEV1</td>
<td>0.31</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>PaCO2</td>
<td>-0.29</td>
<td>NS</td>
</tr>
<tr>
<td>DCO</td>
<td>0.05</td>
<td>NS</td>
</tr>
<tr>
<td>FEV1/FVC</td>
<td>0.04</td>
<td>NS</td>
</tr>
<tr>
<td>PaO2</td>
<td>0.01</td>
<td>NS</td>
</tr>
</tbody>
</table>

versely affected because they cannot maintain pace with their peers. In addition, the patient with COPD soon realizes that his disease is irreversible and progressive.

Although our patient population was more depressed than the general medical population, it was not more anxious. In the present study, the State-Trait Anxiety Inventory developed by Spielberger et al was used to assess anxiety. The validity of this test is well established. We compared the level of anxiety in our population to 110 male patients on the general medical or surgical wards in VA Hospitals surveyed by Spielberger et al. The levels of anxiety observed in our population were very similar to those observed in this control population.

The reported prevalence of 42 percent for depression and 2 percent for anxiety in the present study probably overstates the case for depression and underestimates it for anxiety. To be considered depressed, a patient in the present study had to have a depression score above an arbitrary cutoff of 14. Approximately 17 percent of the general medical population will meet this criterion. However, only 5 percent of the general medical population will meet our criteria for anxiety. It should be noted that the mean anxiety scores for our patients were significantly higher than those of college students.

We were surprised that there was not a higher prevalence of anxiety in our patient population. Dudley et al suggest that anxiety and depression are both quite prevalent in patients with COPD. Other researchers have reported a high prevalence of anxiety in patients with COPD. However, most of these reports studied relatively small numbers of patients and compared their anxiety levels to those of young healthy individuals. Aitken et al reached a conclusion similar to ours in a study of 12 older asthmatic patients.

One possible source of bias in the present study is that those patients who were most anxious refused to participate in the study. Indeed, the most frequent excuse given by patients for not participating in the study was that they had a dislike for psychologic testing and anything else to do with psychiatrists. However, those patients who refused to participate in the study did not generally appear more anxious than those who agreed to participate.

Dudley et al have hypothesized that patients with COPD who are depressed also tend to have high levels of anxiety. Nevertheless, we were surprised at the close relationship between the anxiety scores and the depression scores (r = 0.81, p < 0.0001). A partial explanation for this close relationship may be content overlap on the psychologic test instruments. For example, one question on the BDI is "I am happy," while a question on the anxiety test is "I am sad." It
would therefore be expected that there would be some correlation between the anxiety scores and the depression scores due to the content of the tests. The closeness of the relationship found in the present study probably does indicate that depression and anxiety tend to occur simultaneously in patients with COPD.

We had hypothesized that the presence of depression and/or anxiety would adversely affect the functional capability of a patient with COPD when the level of pulmonary dysfunction was taken into consideration. The present study offers no support for this hypothesis since there were no significant relationships between the 12-minute walking distance and the depression or anxiety scores.

The correlation coefficients between the 12-minute walking distance and the various measures of pulmonary function (Table 2) are generally lower than those reported by other investigators. The explanation for the relatively low correlation coefficients is probably the narrow range of expiratory flow rates that was required for our population. The correlations would have been better if patients with less severe disease had been included.

It is known that many factors can affect the exercise performance of an individual with a given degree of pulmonary dysfunction such as his general health, level of physical conditioning, genetic make-up, and the presence or absence of other complicating disease. It is quite possible that alleviation of depression or anxiety in an individual patient might lead to a higher functional capacity. Indeed, in one previous study, the administration of antidepressants to depressed patients with chronic bronchitis markedly increased the exercise tolerance of most patients. In another study, the administration of diazepam to anxious patients with emphysema resulted in an increased exercise tolerance. Neither of these studies was controlled or blinded. Further studies are necessary to evaluate how the functional capacity of an individual patient is affected if the depression or anxiety level is reduced.

The present study has demonstrated that there is a high prevalence of depression in COPD patients who are not hypoxemic. Although the anxiety levels are similar to those of other patients with medical disease, those patients who are depressed also tend to have higher anxiety levels. In this study, there was no significant relationship between the functional capacity as measured by the 12-minute walking distance and the psychologic test results. However, the possibility exists that alleviation of depression or anxiety in a given individual would result in his having a greater functional capacity.

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REFERENCES