Psychological outcomes of an outpatient pulmonary rehabilitation program in patients with chronic obstructive pulmonary disease

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\textbf{Summary}
\textbf{Study/principles:} The effects of an outpatient pulmonary rehabilitation program on psychological morbidity (anxiety and depressive symptoms) were examined in patients with chronic obstructive pulmonary disease (COPD).

\textbf{Methods:} The 26 rehabilitation patients with COPD were compared with 19 control patients with COPD similar in age, gender, COPD severity and other variables. Initial assessment included lung function testing, health status, exercise tolerance, dyspnea intensity and psychiatric interviews using Hamilton depression rating scale (HAM-D) and Hamilton anxiety rating scale (HAM-A). A pulmonary rehabilitation program was carried out during the following 2 months; psychiatric interviews and measurements of health status, exercise tolerance and dyspnea intensity were done again on completion of the study at 2 months.

\textbf{Results:} There was a decrease in HAM-A scores in the rehabilitation group and the decrease was statistically significant ($P = 0.010$). On the contrary the HAM-A scores did not change in control group. The decrease in HAM-A scores in rehabilitation group was also statistically significant compared with the control group ($P = 0.042$). There was no significant difference in HAM-D scores within the two groups and also there was no significant difference between the two groups in HAM-D scores. The health status, exercise tolerance and dyspnea intensity improved significantly in the rehabilitation group compared to the control group.

\textbf{Conclusion:} This study shows that our outpatient rehabilitation program leads to a benefit in anxiety and depressive symptoms in COPD patients. The benefit was especially significant in anxiety symptoms. In addition to the improvement in...
psychological symptoms, the health status, exercise tolerance and dyspnea intensity were also significantly improved in COPD patients who underwent the rehabilitation program. This outpatient-based rehabilitation program was well accepted by the patients. The relatively simple design of the program makes it feasible independently of expensive equipment.

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Introduction

Chronic obstructive pulmonary disease (COPD) is characterized by impaired respiratory airflow, accompanied by an increasingly sedentary lifestyle. A sedentary life-style, in turn, contributes to reductions in functional capacity and physiologic reserve, leaving the COPD patient with exertional dyspnea, which often progresses into dyspnea at rest. In addition to progressive physical disability, past studies have found relatively high levels of depression and anxiety among COPD patients. Depression and anxiety contribute more to functional disability, poor health perception, and poor well-being than many chronic medical conditions. Patients with both chronic medical illness and depression symptoms are functionally more disabled than those with either a chronic medical illness or depression alone. Furthermore, patients with both conditions use greater resources, more primary care services and more emergency care than patients with chronic illness without depression. Recent studies also report a significant relationship between the functional status of COPD patients and the presence of anxiety or depression. Furthermore, several studies indicate that pharmacotherapy of depression or anxiety in COPD patients improves functional capacity.

It has been suggested that changes in mood among COPD patients may result from negative self-perceptions and restrictions in behavioral functioning that are directly related to decreased physical capacity. The clinical syndromes of depression and anxiety may, in turn, further reinforce the COPD patient’s social isolation and physical inactivity.

Pulmonary rehabilitation programs aim at improving dyspnea, exercise tolerance and the overall quality of life. Several studies have shown benefits of rehabilitation in patients with COPD. Some studies have examined effects of pulmonary rehabilitation programs for anxiety and depression in patients with COPD. After extensive multidisciplinary rehabilitation, improved psychological symptoms have been observed. Levels of depression and anxiety improved significantly in patients with COPD after a 30-day exercise and rehabilitation program. In a subsequent study, Emery et al. found decreased anxiety among patients with COPD participating in a comprehensive 10-week rehabilitation program (exercise, education and stress reduction) compared with a group receiving education and stress reduction alone. Similarly, Withers et al. examined the effects of an outpatient pulmonary rehabilitation program on anxiety in patients with severe COPD. Their 6-week program included exercise training, education, psychosocial support and stress management. They too found that the multifaceted pulmonary rehabilitation program produced significant reductions in anxiety symptom severity. One study examined exercise alone. Participants who received 14 or 28 weeks of aerobic activity experienced a significant decrease in anxiety. Thus, it appears that multicomponent rehabilitation programs that include exercise plus psychoeducational components can produce meaningful reductions in anxiety severity. These studies demonstrated that exercise alone as well as a combination of exercise, education and stress management produce a decline in anxiety symptoms. According to cognitive-behavioral models of anxiety, physical sensations and anxiety are strongly linked. The exercise component may act as a type of exposure therapy breaking the link between physical sensations and anxiety.

The purpose of the present study was to examine the effects of an outpatient pulmonary rehabilitation program on depressive and anxiety symptoms in patients with COPD. Although exercise conditioning has been found to improve the physical capacity of COPD patients, few studies have examined the effects of exercise on the psychological well-being of COPD patients. It was hypothesized that subjects completing the rehabilitation program experienced improved psychological well-being.

Patients and methods

Patients

The study included 52 patients who were treated in the COPD outpatient unit of Department of Pulmonology, School of Medicine, Ege University,
Izmir, Turkey. COPD was diagnosed in patients according to the global initiative for chronic obstructive lung disease (GOLD) criteria. Criteria for inclusion in the study were: (1) age between 50 and 75 years; (2) history of smoking over 20 years and no smoking for at least 1 year; and (3) to be in a clinically stable condition (no exacerbations within the last 8 weeks).

No changes were made in their drug therapy during the study period. Patients with severe heart disease, malignant disease, acute respiratory infection, musculoskeletal disorders, peripheral vascular disease or other disabling diseases and the patients under long-term oxygen treatment were excluded from the study. The patients were randomised to two groups. The patients who met inclusion criteria were dispersed one by one into two groups. The patients were randomised after they were referred to pulmonary rehabilitation by their physicians. Twenty-six of the patients who participated in the rehabilitation program were enrolled in the study group and 26 of the patients who did not to participate in the rehabilitation program were enrolled in the control group. From the control group seven patients did not appear for their psychiatric interviews and other measurements at the end of the study and the control group was included only 19 patients. It has been found more sensitive for determining each item’s rating. The 17 items are rated on either a five-point (0–4) or a three-point (0–2) scale. In general, the five-point scale items use a rating of 0 = absent, 1 = doubtful to mild, 2 = mild to moderate, 3 = moderate to severe and 4 = very severe. A rating of 4 is usually reserved for extreme symptoms. The three-point scale items use a rating of 0 = absent, 1 = probable or mild and 2 = definite. Score level of depression is 0–7; no depression, 8–12; mild depression, 13–17; mild to moderate depression, > 17: moderate to severe depression. The highest score of the scale is 53.

The HAM-D is a 17-item scale that evaluates depressed mood, vegetative and cognitive symptoms of depression, and comorbid anxiety symptoms. It provides ratings on current DSM-IV symptoms of depression, with the exceptions of hypersomnia, increased appetite and concentration/indecision. The HAM-D was originally designed to be administered by a trained clinician using a semi-structured clinical interview. The administrator must be experienced in clinical psychopathology. The HAM-D measures the change in severity of depressive symptoms. It is not used for the diagnosis of depression.

However, Hamilton provided only general guidelines for the administration and scoring of the scale. No standardized probe questions were provided to elicit information from patients and no behaviorally specific guidelines were developed for determining each item’s rating. The 17 items are rated on either a five-point (0–4) or a three-point (0–2) scale. In general, the five-point scale items use a rating of 0 = absent, 1 = doubtful to mild, 2 = mild to moderate, 3 = moderate to severe and 4 = very severe. A rating of 4 is usually reserved for extreme symptoms. The three-point scale items use a rating of 0 = absent, 1 = probable or mild and 2 = definite. Score level of depression is 0–7; no depression, 8–12; mild depression, 13–17; mild to moderate depression, > 17: moderate to severe depression. The highest score of the scale is 53.

Psychologic assessment
Anxiety and depressive symptoms in patients were assessed using the Hamilton depression rating scale (HAM-D) and Hamilton anxiety rating scale (HAM-A) by a psychiatrist, who was trained and experienced in using these scales. The psychiatrist was blinded to the randomization group of the patients.

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The HAM-D was one of the first rating scales developed to quantify the severity of depressive symptomatology. First introduced by Max Hamilton in 1960, it has since become the most widely used and accepted outcome measure for evaluating depression severity.

The psychometric properties of the original clinician-administered scale has been well documented. It has been found more sensitive as a treatment change measure (both drug and psychotherapy) than several self-rated scales.
The Hamilton anxiety scale consists of 14 items, each defined by a series of symptoms. As was the case with the HAM-D, Hamilton provided only general guidelines regarding the administration and scoring of the scale. No standardized probe questions to elicit information from patients, or behaviorally specific guidelines were developed for determining item scoring. The administrator must be experienced in clinical psychopathology. Similar to the HAM-D, each item is rated on a five-point scale, ranging from 0 (not present) to 4 (severe). The highest score of the scale is 56.

The HAM-A was one of the first rating scales developed to quantify the severity of anxiety symptomatology. Since its introduction by Max Hamilton in 1959, it has become a widely used and accepted outcome measure for the evaluation of anxiety in clinical trials.

Study design
An initial assessment was performed in all patients. During the following 2 months the rehabilitation program was carried out. The other assessments were performed at the end of second month.

Rehabilitation program
The patients in the study group in addition to their medical treatment underwent an outpatient pulmonary rehabilitation program for 2 months, 3 days and 2 1/2 h weekly. The rehabilitation program included:

1. **Education**: This consisted of group sessions and private counseling on the anatomy and physiological basis of COPD, medicinal information, nutrition, adaptation to COPD and advice on how to manage with COPD in everyday life (one session of, half an hour, weekly).
2. **Relaxation exercise**: Relaxation exercises identified by Jacobson were applied to patients.
3. **Bronchial hygiene program**: The purpose of this part of the program was to teach the patients the most effective way of coughing to clean their lungs. The patients were also taught how to remove secretions from their lungs using simple postures.
4. **Breathing retraining**: The aim of this stage was to teach the patients how to breathe in the most effective way in different situations. The most important components of retraining were: pursed lip breathing, diaphragmatic breathing, segmental breathing and walking with a forward leaning posture. The importance of using these breathing techniques especially during exercise and other physical activities was emphasized.
5. **Upper body muscle strengthening exercises**, postural exercises and chest mobilizing exercises.
6. **Warm-up gymnastics**, high intensity upper and lower extremity training—e.g. 15 min of rapid walking and 15 min of arm ergometry—cool-up gymnastics.
7. **Cardiopulmonary exercise**: 15 min riding on a stationary bicycle.

Statistical analysis
Statistical analyses were performed with a Statistical Package for Social Sciences for Windows 10.0. Comparisons of patients’ parameters in groups were done using paired-samples t-test and comparisons of patients’ parameters between groups were done using independent-samples t-test. Non-parametric tests, Wilcoxon signed ranks test and Mann–Whitney U-test, were used when parametric tests were inappropriate. Comparison of scores of HAM-D and HAM-A scales between groups was done using Repeated Measures Test. \( \chi^2 \)-test was used to compare mean values between groups. Results were expressed as mean ± standard deviation (SD). The significance level was set at \( P < 0.05 \).

Results
Fifty-two patients were included in the study but only 45 patients completed the study. Twenty-six patients were in rehabilitation group and 19 patients were in the control group. The rehabilitation program was well tolerated and accepted among patients; there were no adverse events. Patients’ socio-demographic characteristics and baseline parameters (smoking, oxygen use, comorbidity, X-ray finding, drug treatments, severity of disease, FVC, FEV1) are shown in Table 1.

According to GOLD criteria one patient was Grade I (3.8%), 15 patients were Grade II (57.7%) and 10 patients were Grade III (38.5%) in rehabilitation group and one patient was Grade I (5.3%), 11 patients were Grade II (57.9%) and seven patients were Grade III (36.8%) in control group. There was no statistically significant difference between the rehabilitation and control groups due to severity of COPD \( (P > 0.05) \).

There was a decrease in HAM-A scores in the rehabilitation group and the decrease was statistically significant \( (P = 0.010) \). On the contrary
the HAM-A scores did not change in control group (Table 2).

There was no significant change in HAM-D scores in the rehabilitation and control groups (Table 3). At the end of the study there was statistically no difference in HAM-D scores between two groups. But there was a statistically significant decrease in HAM-A scores in the rehabilitation group when compared to the control group ($P = 0.042$) (Table 4).

The health status, quality of daily life (SGRQ), dyspnea intensity (VVAS) and exercise tolerance (SMWT) improved significantly in the rehabilitation group compared to the control group (Tables 5–7).

### Discussion

Our study found significant improvement in anxiety symptoms in COPD patients in the rehabilitation
group, compared to the control group. It has been proposed that anxiety is closely associated with dyspnea in COPD patients and exercise training alone or rehabilitation programs result in decreases in dyspnea and dyspnea-related anxiety.\textsuperscript{24} In the present study, dyspnea intensity (VVAS) also improved significantly in the rehabilitation group compared to control group. There was no significant improvement in depressive symptoms in both groups. We suggest that improvement in depressive symptoms (especially the core symptoms of depression like depressive mood and anhedonia) with pulmonary rehabilitation programs is much more difficult.

The health status, quality of life (SGRQ) and exercise tolerance (SMWT) also improved significantly in the rehabilitation group compared to control group in our study. Our results are in line with the previous studies. Pulmonary rehabilitation programs aim at improving dyspnea, exercise tolerance and the overall quality of life. Several studies have shown benefits of rehabilitation in patients with COPD.\textsuperscript{25–28}

These data suggest the efficacy of pulmonary rehabilitation in psychological well-being among patients with COPD. Psychological measures indicate that subjects experienced improved well-being, including reductions in anxiety and depression, following the rehabilitation program. Our results support previous studies\textsuperscript{29–35} and indicate that psychological improvement follows rehabilitation in patients with COPD.

Our study has some advantages. First, the way in which anxiety and depressive symptoms are measured is very important in such studies. The researchers need to use assessment instruments that have demonstrated reliability and validity. The present study includes a more extensive assessment of psychological well-being. A psychiatrist who is experienced in using HAM-D and HAM-A scales assessed the anxiety and depressive symptoms in COPD patients. So the measurement of depressive and anxiety symptoms is more reliable than measurements in other numerous studies using self-report scales for depressive and anxiety symptoms. Another advantage of our study is the

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<th>Table 5</th>
<th>Comparison of mean VVAS scores of the rehabilitation and control groups at baseline and at the end of rehabilitation program.</th>
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<tbody>
<tr>
<td></td>
<td>VVAS\textsubscript{1}</td>
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<tr>
<td>Rehabilitation group ((n = 26))</td>
<td>5.96 ± 2.03</td>
</tr>
<tr>
<td>Control group ((n = 19))</td>
<td>5.29 ± 2.08</td>
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VVAS, vertical visual analogue scale.
\*Statistically significant (\(P < 0.05\)).

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<th>Table 6</th>
<th>Comparison of mean SMWT scores of the rehabilitation and control groups at baseline and at the end of rehabilitation program.</th>
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<tr>
<td></td>
<td>SMWT\textsubscript{1} (m)</td>
</tr>
<tr>
<td>Rehabilitation group ((n = 26))</td>
<td>261.67 ± 141.5</td>
</tr>
<tr>
<td>Control group ((n = 19))</td>
<td>226.82 ± 172.7</td>
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SMWT, 6-min walk test.
\*Statistically significant (\(P < 0.05\)).

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<tr>
<th>Table 7</th>
<th>Comparison of mean SGRQ scores of the rehabilitation and control groups at baseline and at the end of rehabilitation program.</th>
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<tr>
<td></td>
<td>SMWT\textsubscript{1}</td>
</tr>
<tr>
<td>Rehabilitation group ((n = 26))</td>
<td>45.08 ± 17.78</td>
</tr>
<tr>
<td>Control group ((n = 19))</td>
<td>50.65 ± 15.23</td>
</tr>
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SGRQ, St. George’s Respiratory Questionnaire.
\*Statistically significant (\(P < 0.05\)).
inclusion of a matched-control group. It may have an implication in the validity of our study.

Our study has some limitations too. Methodological problems (e.g. the small number of participants in both groups) likely reduced the overall generalizability of our findings.

Our study results provide no indication of possible mechanisms responsible for change in psychological well-being. Improvement on psychological measures may be a reflection of motivational factors and social support provided by regular meetings in a group setting.

The program was suggested to be psychotherapeutic for a patient in at least the following ways: (a) by providing long-term emotional support to the patient through continuing social interaction with the staff; (b) by encouraging the patient to experience mastery over his chronic disease, and optimism about controlling it, through education and through the learning of specific medical techniques for dealing with it (e.g. systematic bronchial hygiene and breathing retraining); and (c) on the assumption that these techniques are effective, by enhancing the patients’ feeling of emotional well-being as a response to his improved physical well-being.

Despite the methodological problems, these findings indicate that patients with COPD are likely to have important psychological improvement after a pulmonary rehabilitation program.

The previous studies37–39 show that pulmonary rehabilitation produces obvious short-term effects on psychological variables, but the effects usually diminish over longer follow-ups. It is obvious that for continuous effects on the psychological well-being, the patients require continuous rehabilitative work. We suggest that simple design of the outpatient-based rehabilitation program used in our study can provide the patients this continuous rehabilitative work.

In summary, we examined the effects of an outpatient-based pulmonary rehabilitation program on anxiety and depressive symptoms in patients with COPD. The program was carried out during 2 months. We found significant decrease in the anxiety symptoms in the rehabilitation group at the end of the program and also this decrease was statistically significant compared to the control group. There was no significant improvement in depressive symptoms in both groups.

As a result this study was planned to examine the feasibility and acceptance of this kind of "modular" pulmonary rehabilitation program. Our study demonstrated that this outpatient-based rehabilitation program is effective and well accepted among patients. The relatively simple design of the program makes it feasible independently of expensive equipment.

References