Turkish Journal of Geriatrics
2013; 16 (4) 427-433

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RESEARCH

PULMONARY REHABILITATION RESPONSE IN ELDERLY AND YOUNGER PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE

ABSTRACT

Introduction: Pulmonary rehabilitation has been shown to improve exercise capacity, health status, anxiety and depression in patients with chronic obstructive pulmonary disease (COPD), but the response in younger and elderly patients has not been fully established. The aim of this study was to investigate the effectiveness of pulmonary rehabilitation in elderly people.

Materials and Method: Younger (≥65 years) and older (>65 years) patients with stable COPD underwent an 8 week outpatient pulmonary rehabilitation procedure twice weekly, along with home exercise training. Dyspnea, incremental shuttle walk distance, health status with St. George's Respiratory Questionnaire, anxiety and depression score were assessed before and after pulmonary rehabilitation. A comparison was made between younger and elderly patients.

Results: The study group included 109 patients with COPD. There were 52 patients (mean age 58.96±4.63 yrs) in the younger group and 57 patients (mean age 73.58±5.75 yrs) in the elderly one. The increase in walking distance in younger patients was 76.86±93.18m (p<0.0001) and 34.64±60.35m (p<0.0001) in the elderly group after the data was compared to the baseline. In the younger group, the decrease in BORG score was -0.46±1.50 (p=0.04) whereas it was -0.12±0.96 (p=0.35) among the elderly patients. Although St. George's Respiratory Questionnaire and hospital anxiety–depression score improved significantly after pulmonary rehabilitation in younger patients, the improvement was only on the 'total' score in the elderly. Comparing the mean changes after pulmonary rehabilitation, both age groups showed similar improvements in dyspnea, St. George's Respiratory Questionnaire and hospital anxiety–depression score (p=NS). Only walking distance increased more in the younger ages after pulmonary rehabilitation (p=0.006).

Conclusion: Elderly patients with COPD can benefit from pulmonary rehabilitation just as younger patients can and need not be excluded because of age.

Key Words: Pulmonary Disease, Chronic Obstructive; Exercise; Quality of Life; Anxiety; Depression; Rehabilitation.

ARAŞTIRMA

PULMONER REHABİLİTASYONUN KRONİK OBSTRÜKTİF AKCİĞER HASTALIĞI OLAN YAŞLI VE GENÇ HASTALARDAKİ SONUÇLARI

ÖZ

Giriş: Pulmoner rehabilitasyonun kronik obstrüktif akciğer hastalığı (KOAH) olan hastalarda egzersiz kapasitesini ve yaşam kalitesini arttırdığı; anksiyete ve depresyonu azalttığı gösterilmesine rağmen yaşlı ve genç hastalardaki sonuçları tam olarak bilinmemektedir. Çalışmamız yaşlı KOAH'lı olgularda, pulmoner rehablitasyonun etkisini saptamak amacıyla yapılmıştır.

Gereç ve Yöntem: Haftada iki kez hastanede ve bir kez evde uygulanan egzersiz programından oluşan; sekiz haftalık pulmoner rehabilitasyon programına katılan stabil KOAH'lı hastalar ≤65 yaş ve >65 yaş olmak üzere iki gruba ayrılmıştır. Dispne, artan hızda mekik yürüme testi, St. George's Respiratory Questionnaire ile yaşam kalitesi, anksiyete ve depresyon skoru pulmoner rehablitasyon öncesi ve sonrasında değerlendirilmiştir. Yaşlı ve genç hastalarda pulmoner rehablitasyonla saptanan değişiklikler karşılaştırılmıştır.

Bulgular: Yüz dokuz hastanın değerlendirildiği çalışmamızda genç hasta grubunda yaş ortalaması 58.96±4.63 olan 52 hasta, yaşlı hasta grubunda da yaş ortalaması 73.58±5.75 olan 57 hasta yeralmıştır. Pulmoner rehablitasyon sonrasında yürüme mesafesinde gençlerde 76.86±93.18 m (p<0.0001) yaşlılarda ise 34.64±60.35 m (p<0.0001) artış saptanmıştır. Genç hasta grubunda BORG skorunda -0.46±1.50 (p=0.04) azalma olurken yaşlılarda dispnedeki azalma -0.12± 0.96 (p=0.35) olarak izlenmiştir. St. George's Respiratory Questionnaire, Hastane Anksiyete Depresyon skorlarında pulmoner rehabilitasyon sonrası gençlerde anlamlı düzelme olmasına rağmen yaşlılarda sadece St. George's Respiratory Questionnaire'ın 'toplam' skorunda anlamlı düzelme olmuştur. Pulmoner rehabilitasyon sonrası dispne, St. George's Respiratory Questionnaire ve Hastane Anksiyete Depresyon skorlarında saptanan ortalama değişimlerin karşılaştırılmasında her iki grup arasında fark bulunmamış (p=NS); artan hızda mekik yürüme testinde pulmoner rehabilitasyon sonrası saptanan artış genç hasta grubunda daha fazla saptanmıştır (p=0.006).

Sonuç: Yaşlı KOAH'lı hastalar da pulmoner rehabilitasyon programlarından genç hastalar kadar yarar görebilmektedir. Bu olgular yaşları dolayısıyla pulmoner rehabilitasyon programından dışlanmamalıdırlar.

Anahtar Sözcükler: Kronik Obstrüktif Akciğer Hastalığı; Egzersiz Kapasitesi; Yaşam Kalitesi; Anksiyete; Depresyon; Rehabilitasyon.

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Geliş Tarihi: 28/11/2012
(Received)

Kabul Tarihi: 03/04/2013
(Accepted)

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Introduction

Chronic obstructive pulmonary disease (COPD) is associated with high mortality and morbidity worldwide (1). However life expectancy has significantly increased over the last 30 years, particularly amongst the elderly (2). COPD is more common in the elderly, with a prevalence twice as high in patients older than 65 than in patients under 65 years of age (3). Thus, the management of COPD in elderly patients has become a relevant and targetted treatment strategy. The main non-pharmacologic goals of stable COPD management are relieving dyspnea, and improving exercise capacity and health related quality of life (HRQoL). The current guidelines strongly recommend pulmonary rehabilitation (PR) in all COPD patients with breathlessness (4). Despite the evidence, there are several factors that limit the optimal response to PR in elderly patients (5). As there is limited data evaluating the effectiveness of PR in elderly patients with COPD, we aimed to compare the outcomes of PR in younger and elderly patients with COPD.

Materials and Method

The study population included the patients who were admitted to the Chest Diseases Department, Pulmonary Rehabilitation Unit of Ege University Medical School Department of Chest Diseases between 2005 and 2010. All patients were referred from the COPD outpatient clinic. Only the data of the patients who had completed the program was evaluated, retrospectively. The diagnosis of COPD was based on a previous smoking history of at least 10 packs per year and fulfilling the criteria for COPD according to the Global Strategy for Diagnosis, Management and Prevention of COPD (GOLD) guideline (4). All patients gave their written informed consent to participate in PR, with a major symptom of breathlessness and limited exercise capacity. At baseline, spirometry was performed pre and post-bronchodilator 15-30 minutes after 400 mcg salbutamol was administered via a spacer device using Sensor Medics 2400, Yorba Linda, USA spirometer; lung functions were expressed as the percentages of the reference values. The criterion for confirmation of a diagnosis of COPD was a post-bronchodilator FEV_1/FVC ratio of <0.7. The severity of airway obstruction was graded according to the GOLD criteria for predicted FEV_1 (mild: FEV_1 ≥80% (predicted), moderate: 50% ≤FEV_1 <80% (predicted), severe: 30% ≤FEV_1 <50% (predicted) and very severe: FEV_1 <30% (predicted) or FEV_1 <50% (predicted)+chronic respiratory failure (4). All patients were ex-smokers and on optimum medical treatment, which included one or more inhaled long acting b_2 -agonists, long acting anticholinergics, inhaled steroids and theophylline. The study was approved by the ethical committee. All study participants provided written informed consent. Patients with concomitant confounding diseases such as neuromuscular disorders, unstable cardiovascular disease (such as recent unstable angina (i.e.,<6 months) myocardial infarction, severe valvular disease, decompensated heart failure and uncontrolled arrhythmias), malignancies, orthopedic problems, severe pulmonary hypertension, acute exacerbation of COPD over the previous 4 weeks and patients who were unwilling to complete the program, were excluded.

The PR program consisted of multidisciplinary hospital based supervised outpatient pulmonary rehabilitation twice weekly, combined with an unsupervised home exercise program once a week. The session included cycle ergometer and treadmill training (15 min each), upper and lower extremity strength training (5-10 min), and breathing and relaxation therapies (15-20 min each) for a total of 70-90 min per day. Patients were trained on a cycling and treadmill ergometer at 50% of peak workload and 50-80% of peak VO_2. Peak workload and peak VO_2 of patients were measured with a cardiopulmonary exercise test. The cardiopulmonary exercise test was performed on a treadmill (Treadmill model 770 CE) with the Bruce protocol. The breath-by-breath technique was used to measure peak VO_2 during the cardiopulmonary exercise test (Masterscreen CPX with metabolic card, Viasys Healthcare, Jaeger, Würzburg, Germany). Pulse oximetry was used during the exercise to monitor whether the SpO_2 fell below 90%, to maintain oxygenation. The education component consisted of 8 sessions of discussions (1 hr per week) regarding the disease. The outcome measures evaluated were: dyspnea, exercise capacity, HRQoL, and psychological status. Dyspnea was assessed with a modified BORG dyspnea scale (6). Exercise capacity was evaluated with the ISWT (7). Health related quality of life was assessed with the Turkish version of a standardized St. George's Respiratory Questionnaire (SGRQ) (8). This is a measurement of health related quality of life which consists of 76 questions evaluating the following domains: symptoms, activity, impact and total score. Lower scores indicate better health status. A change of four or more units from the baseline score after treatment was considered clinically significant (9). Body Mass Index (BMI) was calculated, with shoes off and light clothing, as weight (kg)/height squared

(m^2). the hospital anxiety–depression (HAD) scale was used for the assessing psychological status (10). All measurements were assessed at the baseline and in the 8th week after the program.

Statistical Analysis

SPSS 20.0 for Windows was used for the statistical analysis. Descriptive statistics were performed for all of the recorded variables. Baseline characteristics between the two groups (young versus elderly) were compared the *t*-test and Mann-Whitney U test. Changes within the groups were analyzed with the Wilcoxon test. The changes between post-treatment and baseline levels are shown as Δ values. Students' *t*-tests were used for comparing Δ values of groups. The significance level was set at $p< 0.05$.

Results

The records of 109 patients who underwent an 8 week outpatient PR, completed this programme, and were assessed after PR, were evaluated. The results of the patients aged 65 and younger were compared with the results of patients over 65. In the remaining 8 patients several medical complications occurred during the programme such as acute ischemic cerebrovascular attack, acute decompensated heart failure, hypertension or neurologic problems. These patients were not evaluated because they did not continue the PR programme. There were 52 patients in the younger group (aged£ 65 years, 48 male) with a mean age of 58.96±4.63, whereas elderly patients (aged >65 years, 55 male) consisted of 57 patients with a mean age of 73.58±5.75. The baseline characteristics including gender, smoking history, lung functions, stage of the disease, use

Table 1— . Baseline Characteristics of the Patients with COPD aged ≤65 Years and >65 Years.

Parameters	Aged ≤65 years (n=52)	Aged >65 years (n=57)	p value
Gender, male/female (n)	48/4	55/2	0.33
Mean age, years	58.96±4.63	73.58±5.75	**<0.0001**
Smoking History (pack/ year)	42.35±27.30	47.36±28.09	0.34
Patients on LTOT (n,%)	9 (17.3)	11 (19.2)	0.78
FVC (% predicted)	66.75±17.94	67.67±14.73	0.77
FEV1 (% predicted)	43.37±15.43	46.12±15.08	0.34
FEV1/FVC (%)	51.94±10.61	52.19±9.19	0.89
Stage of the Disease (n,%)			0.25
Stage I	2 (3.8)	3 (5.3)	
Stage II	11 (21.2)	20 (35.1)	
Stage III	28 (53.8)	28 (49.1)	
Stage IV	11 (21.2)	6 (10.5)	
BMI (kg/m^2)	21.67±4.33	22.71±4.61	0.22
Comorbid Illness (n,%)			
Cardiovascular disease	13 (25)	19 (33.3)	0.34
Diabetes Mellitus	7 (13.4)	1(1.7)	**0.02**
ISWT (m)	317.69±171.56	265.61±128.37	0.07
Exercise BORG	3.54±1.79	3.40±1.69	0.68
SGRQ			
Total score	53.54±21.15	49.81±20.94	0.36
Symptoms	60.01±21.46	52.63±23.27	0.09
Activity	65.81±20.39	64.46±20.45	0.73
Impact	44.23±25.57	40.69±24.02	0.46
HAD scale			
Depression	7.35±3.40	6.55±3.67	0.28
Anxiety	7.73±4.75	6.77±5.17	0.32

Abbreviations: Values are expressed as mean± SD unless indicated otherwise. LTOT= Long term oxygen therapy; FVC= Forced expiratory volume; FEV1= Forced expiratory volume in the first second of expiration; BMI= Body Mass Index; ISWT= Incremental Shuttle Walk Test; BORG= BORG dyspnea index; SGRQ= St George's Respiratory Questionnaire; HAD scale= Hospital Anxiety-Depression scale.

of long term oxygen therapy, body mass index, dsypnea measurement, exercise capacity, HRQoL, anxiety and depression scores were similar in both groups (p>0.05). FEV_1 (% predicted) was 43.37±15.43% in younger patients and was 46.12±15.08% in the elderly (p=0.34). Although baseline ISWT distance in younger patients (317.69±171.56 m) was higher than in the elderly patients (265.61±128.37 m), the difference was not significant (p=0.07). Body mass index was measured as 21.66±4.32 kg/m^2 in younger patients and 22.71±4.60 kg/m^2 in the elderly (p=0.22). The baseline characteristics of the patients are presented in Table 1.

The Changes in Outcome Measures After Pulmonary Rehabilitation

Exercise capacity (ISWT), dyspnea (BORG), health related quality of life (SGRQ), anxiety and depression (HAD scale) were reassessed after a comprehensive PR program in both younger and elderly groups. The ISWT distance increased significantly in both younger (ΔISWT: 76.86±93.18 m, p<0.0001) and in elderly patients (ΔISWT: 34.64±60.35 m, p<0.0001). The improvement in dyspnea was also significant in younger patients, but dyspnea decreased in the elderly patients as well (ΔBORG: -0.46±1.50, p=0.04 and -0.12±0.96, p=0.35, respectively). Despite the improvements in all areas of SGRQ in the younger group (p<0.05), only the 'total' score decreased in elderly patients (p=0.02). The decrease in the HAD anxiety score was -0.88±2.74 (p=0.038) and in the depression score was -1.32±2.70 (p=0.004) in the younger group. The improvements in anxiety and depression were not statistically significant in the elderly patients (for both, p> 0.05). The effects of the PR program on the outcomes are shown in Table 2.

Comparing the Effects of PR in Younger and Elderly Patients

Although ISWT scores did not differ between the two groups at baseline, the improvement was significantly higher in younger patients (76.86±93.18 m) compared to the older ones (34.64±60.35 m) (p=0.006) (Figure 1). Although exertional dyspnea was reduced in both groups after PR, there was no significant difference between the groups (p=0.16). The improvement in the 'symptoms' domain of the SGRQ had a tendency to be higher in younger patients (-7.65±15.76 unit) than in elderly patients (-1.41±16.57 unit), (p=0.052). However, the decrements in the 'total' score in both groups were not significant (p= 0.26). In the psychometric assessment, the improvement in depression and anxiety were not significant among either younger and older patients (p=0.41 and p=0.10, respectively). All the data regarding the comparison between younger and elderly patients are summarized in Table 3. Walking distance improved more in younger patients than in the elderly group.

Discussion

Our study showed that an 8 week outpatient PR program improved dsypnea, HRQoL, anxiety and depression in elderly COPD patients as much as the ones in the younger

Table 2— The Comparisons of Pre and Post Rehabilitation Parameters within the Groups (mean±SD).

	Aged ≤65 years (younger patients)			Aged >65 years (elderly patients)		
Parameters	Baseline	After 8 Weeks Rehabilitation	p value	Baseline	After 8 Weeks Rehabilitation	p value
ISWT (m)	317.69±171.56	391.96±166.99	**<0.0001**	265.61±128.37	300.18±137.51	**<0.0001**
Exercise BORG	3.54±1.79	3.13±1.63	**0.04**	3.40±1.69	3.32±1.59	0.35
SGRQ						
Total score	53.54±21.15	47.15±20.56	**<0.0001**	49.81±20.94	45.96±19.45	**0.02**
Symptoms	60.01±21.46	51.86±22.62	**0.002**	52.63±23.27	51.21±22.59	0.49
Activity	65.81±20.39	59.73±21.21	**0.004**	64.46±20.45	61.56±20.50	0.11
Impact	44.23±25.57	38.52±23.48	**0.007**	40.69±24.02	36.71±23.27	0.92
HAD scale						
Depression	7.35±3.40	6.42±3.73	**0.038**	6.55±3.67	6.02±3.64	0.28
Anxiety	7.73±4.75	6.44±4.17	**0.004**	6.77±5.17	6.07±4.73	0.36

Abbreviations: Values are expressed as mean± SD unless indicated otherwise. ISWT= Incremental Shuttle Walk Test; BORG= BORG dyspnea scale; SGRQ= St George's Respiratory Questionnaire; HAD scale= Hospital Anxiety-Depression scale.

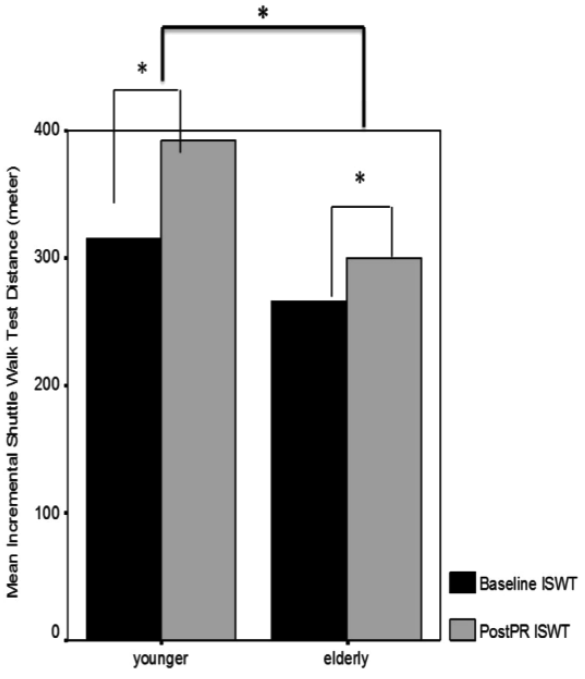

Figure 1— The changes in incremental shuttle walk test (ISWT) distances for the younger and elderly patients with COPD both pre and post rehabilitation period; group comparisons are also shown. The increase in ISWT in both groups was significantly higher after the intervention. Also in the between group comparisons of the Δmean changes, ISWT distance was the only significant parameter among the other parameters evaluated. Data are mean±SD values. ** p<0.05, versus baseline, * p=0.006, between comparisons changes in groups.*

Table 3— The Comparisons Between Δ Mean Changes of Parameters in Both Groups (mean±SD).

Parameters	Aged ≤65 Years Δ Mean Change	Aged >65 Years Δ Mean Change	p value
ISWT (m)	76.86±93.18	34.64±60.35	0.006
Exercise BORG	- 0.46±1.50	-0.12±0.96	0.16
SGRQ			
Total score	-5.90±10.88	-3.60±10.01	0.26
Symptoms	-7.65±15.76	-1.41±16.57	0.052
Activity	-5.60±14.39	-3.00±13.97	0.35
Impact	-5.21±13.80	-3.42±11.99	0.48
HAD scale			
Depression	-0.88±2.74	-0.45±2.58	0.41
Anxiety	-1.32±2.70	-0.45±2.63	0.10

Abbreviations: Values are expressed as mean± SD unless indicated otherwise. ISWT= Incremental Shuttle Walk Test; BORG= BORG dyspnea scale; SGRQ= St George's Respiratory Questionnaire; HAD scale= Hospital Anxiety-Depression scale.

group, except in 'exercise capacity' where the improvement in walking distance in the elderly was less than in younger patients.

There is increasing evidence regarding the positive effects of PR in elderly patients (11,12). However, the characteristics of the patients who are more likely to benefit from PR are not clearly outlined or understood. There are several factors that make the management of COPD difficult and hamper the response to PR in the elderly groups. With the effect of increasing age, COPD patients usually reduce their physical activity more due to exertional dyspnea and the loss of skeletal muscle, which may further contribute to diminished quality of life. Couser et al. studied the effects of outpatient PR in 28 elderly patients (mean age=78 years) compared with 56 younger patients (mean age=64) and found no significant differences in 12-minute walking distance between the two groups (13). Sundararajan et al. showed that elderly patients derived similar benefits to younger patients in exercise capacity, dyspnea and quality of life scores. The ISWT distance increased by a mean of 33.6m in the elderly and 50.1m in the younger patients, although the difference was not significant after the intervention in their study (1). In a recent study, the outcomes of a PR programme on the patients - divided into 3 main groups as group A (<65 years), group B (65-74 years) and group C (≥75 years) - were assessed. The 6MWD, isometric quadriceps strength, health-related quality of life, maximal load, peak oxygen uptake, and maximal inspiratory and expiratory pressures were significantly improved in each of the groups at 3 and 6 months, compared with the baseline. The percentage changes from the baseline at 6 months for all parameters studied were not significantly different between the groups (14). In our study, the improvement in walking distance in younger patients was better than in elderly patients. The changes in exercise BORG, quality of life, depression and anxiety scales were not statistically or significantly different between the older and younger groups. In line with our study, Balzan et al. (15) showed that inpatient PR improved 6MWT and global function in 43 elderly patients (aged between 80-91), although the younger group had greater improvements. A recent report from the Evaluation of COPD Longitudinally to Identify Predictive Surrogate Endpoints (ECLIPSE) longitudinal study (16) highlighted that the six minute walking distance (6MWD) was capable of identifying a COPD population at a higher risk of exacerbation-related hospital admissions or death. In particular, these authors showed a mean rate of deterioration in the 6MWD of 5.7 m

per year that was influenced by the severity of airflow limitation in the GOLD stage: those in GOLD stage II did not significantly decline, whereas those in GOLD stages III and IV showed a significantly higher rate of decline over 3 years. Thus, it remains fundamental to quickly improve reduced functional capacity in elderly people with COPD, which is often left untreated and most often continues to decline toward disability and loss of independence.

Recent evidence suggests that systemic effects of COPD and aging together eventually result in poor body composition and functionality (17). This may be one of the limiting factors in elderly patients walking shorter distances than younger patients, even after rehabilitation. The worsening of cardiovascular diseases, nutritional depletion due to muscle loss, and anemia and osteoporosis in turn may affect the response to PR. Therefore, older patients are generally thought to be 'too old' to tolerate the planned interventions for these reasons (1, 18). In our present study, although cardiovascular disease was more common in elderly patients (33% vs 25%), there was no significant difference between the groups and therefore it did not contribute any adverse effects to the response to PR in elderly patients. DiBonaventura et al. investigated the impact of COPD on quality of life and productivity loss among elderly US adults. They concluded that, even in employed adults aged 65 and older with COPD, quality of life and work productivity decreased due to the disease (19). In our study HRQoL improved in all areas for younger patients, whereas this improvement was only in the 'total' score in the elderly group, but there was no statistically significant difference between the two groups. Thus, it can be expected that elderly patients are capable of similar improvements from PR to those of the younger patients.

Depression, which is highly prevalent among older patients with COPD, is the only recognized risk factor for negative outcomes of respiratory rehabilitation (20). Indeed, it has been shown that depressed patients derive less benefit and have a high drop out rate from PR (21). Drop out reasons due to aging were not evaluated in our study. We observed that there was no significant decrease in HAD scale for both anxiety and depression in elderly patients within group comparisons, after the intervention. Anxiety and depression have been demonstrated to be associated with severe clinical worsening, reduced quality of life, healthcare utilization and mortality. Clinical studies have shown that depressive symptoms are also the most important determinants of quality of life in patients with COPD (22). Particularly, individuals with COPD and depression were 2.5 times more likely to have functional impairment than patients without depressive symptoms. Anxiety and depression have been shown to be correlated with negative outcomes, even following rehabilitation programs (23). Selcuk et al. showed that anxiety and depression scores were decreased after PR in both groups (≥75 and <75 years old) and at the same time the anxiety rate was significantly reduced in the elderly patient group (24). Coventry and Hind recently confirmed that a specific pulmonary rehabilitation program including aerobic exercise, lifestyle education and social support was shown to significantly reduce anxiety and depression (25). In our study, we could not provide any structured social support for the elderly patients. This will need to be studied separately. In the comparisons between younger and elderly groups, the decrease in anxiety and depression were not significant for either group. The treatment of anxiety and depression, particularly in elderly COPD patients, is of considerable clinical importance. Pulmonary rehabilitation can contribute to improving mood status. Thus the combination of pharmacology and psychotherapy may be recommended to improve physical functioning and quality of life in elderly patients with COPD. Although there is a strong suggestion that older patients have limited capacity due to physiological changes, there is increasing data to not exclude this group of patients.

In conclusion, because of the increasing prevalence of COPD in the elderly group, management strategies covering both pharmacological and non-pharmacological interventions should be specified for this group of patients. Pulmonary rehabilitation has been shown to be an effective intervention in younger patients, but the effect in the elderly has not been fully established. This study confirmed that, except for the improvement in exercise capacity, elderly patients with COPD improved dyspnea, health related quality of life, anxiety and depression as much as the younger ones. Therefore, the authors strongly recommend PR for all medically suitable elderly patients with COPD.

ACKNOWLEDGMENT

The authors thank Professor Juzar Ali, MD, for his editorial guidance.

Disclosure Statement

The authors declare that there are no potential conflicts of interest to disclose.

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