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Effectiveness of Home-based Pulmonary Rehabilitation in Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Pulmonary rehabilitation (PR) is an effective intervention for chronic obstructive pulmonary disease (COPD). However, uptake of PR is low due to patient frailty, transportation issues and access. Home-based rehabilitation has been introduced in recent years to palliate the lack of feasibility for many patients to attend traditional center-based PR programs. Hence, this study was conducted to evaluate COPD patients in home-based PR. A total of 56 patients were evaluated for 6 months' period in 4 different occasions. It was concluded that home-based PR was effective as improvement occurred in all parameters.

Keywords: Pulmonary rehabilitation, chronic obstructive pulmonary disease, noninvasive ventilation

Chronic obstructive pulmonary disease (COPD) is the third leading cause of mortality worldwide. COPD is a chronic condition for which patients are using various pharmacological and nonpharmacological therapies. Pulmonary rehabilitation (PR) is one of the nonpharmacological therapies.[1] PR program can be conducted either in facility-based settings or in home-based settings. PR is an effective intervention for COPD. However, uptake of PR is low due to patient frailty, transportation issues and access.[2,3] Home-based PR program is mainly offered in severe COPD and to increase the participation rate of patients. A home-based PR program is more feasible and convenient, especially for patients with severe COPD.[4] Home-based rehabilitation has been introduced in recent years to palliate the lack of feasibility for many patients to attend traditional center-based PR programs.[5,6] Owing to its physiological and functional effects, PR has been considered unsuitable for older people with COPD, especially for those at risk of chronic respiratory failure.[4] Few studies have evaluated the effectiveness of PR in people with COPD over the age of 70, in comparison to their younger counterparts. Thus, the main aim of this study was to evaluate effectiveness of PR in patients who are either older or younger than 70 years.

MATERIAL AND METHODS

This was an observational study conducted in a private setup offering home-based PR for people with chronic respiratory disease living in central India, from September 2019 to August 2020 (6-month enrolment followed by 6 month follow-up assessment). Participants were referred to the home-based PR by their pulmonologist who diagnosed COPD according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) classification system.[1] Patients who had cardiovascular disease, any contraindication to exercise training, e.g., neurological sequelae and bone and joint diseases, dementia and poorly controlled psychiatric illness, were excluded from study.[7] Participants were divided into two groups: one group included individuals aged ≤70 years, and the other one, people >70 years. The cut-off of 70 years to define the older group was chosen in accordance with the World Health Organization (WHO) report on aging and health.[8] All participants signed a written informed consent prior to the start of the program, which included their approval to use the collected data for research purposes.

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The rehabilitation team was composed of one nurse, one physiotherapist, one adapted physical activity instructor, and a weekly supervised 90-minute home session, for 8 weeks was conducted. The program included an initial educational needs assessment, endurance physical exercise training, specific daily living functional task training, strengthening and balance exercises, lower limb electrostimulation, therapeutic education, psychosocial support and motivational communication. Exercise intensity was progressively adjusted to dyspnea symptoms in order to maintain a score between 3 and 5 on the Borg 0-10 scale. Apart from the weekly visit of the team member who supervised the sessions, participants were expected to perform, on their own, personalized daily physical activities and endurance exercises training the rest of the week. Patients and team members were instructed to announce all adverse events, including study withdrawal for any reasons, hospitalization or death during PR at the 6-month follow-up.

Patients were evaluated at home at the beginning (M0), at the end of the 2 months PR program (M2) and at 4 months (M4) and 6 months (M6). The 6-minute walk test (6MWT) and the timed up-and-go (TUG) test were used to evaluate exercise tolerance and functional capacity, respectively. The psychological status and the health-related quality of life were assessed with the Hospital Anxiety and Depression (HAD) scale and the Visual Simplified Respiratory Questionnaire (VSRQ), respectively.

RESULTS

Table 1 is showing baseline characteristics of patients. From September 2019 to August 2020, total 86 patients were enrolled and referred for home PR. Among them, 14 patients refused to participate and 16 patients left the study in between the process and out of these 16 patients, 12 were aged >70 years. Thus, a total of 56 patients completed the study; out of them, 52 were male and 4 were females. Majority of patients (47) were aged <70 years and remaining (9) were >70 years. Out of 56 patients, 29 patients had comorbidities and 37 patients were categorized as severe and very severe COPD according to GOLD guidelines 2019. Among them, 25 patients were current smoker. Out of total patients, 6 patients were on long-term oxygen therapy (LTOT) and 3 patients were using noninvasive ventilation (NIV), and all of them were aged <70 years.

At baseline, the younger group had lower mean HAD total score (14.00) as compared to older group (14.56), but it was statistically nonsignificant ($p > 0.05$). Anxiety and depression scores were also lower in younger group than older group, but it was also statistically nonsignificant ($p > 0.05$). This means anxiety and

Table 1. Baseline Characteristics of Participants

Characteristics	Total group (n = 56)	≤70 years (n = 47)	>70 years (n = 9)	P value
Age (years)	63.55 ± 7.9	61.28 ± 6.35	75.44 ± 2.92	0.001
Male	52 (92.9)	43 (91.5)	9 (100.0)	0.364
Female	4 (7.1)	4 (8.5)	0 (0.0)	
Current smokers	25 (44.6)	21 (44.7)	4 (44.4)	0.353
Ex-smokers	23 (41.1)	18 (38.3)	5 (55.6)	
Nonsmokers	8 (14.3)	8 (17.0)	0 (0.0)	
LTOT	6 (10.7)	6 (12.8)	0 (0.0)	0.257
NIV	3 (5.4)	3 (6.4)	0 (0.0)	0.436
Gold stage				
Mild	4 (7.1)	3 (6.4)	1 (11.1)	0.693
Moderate	15 (26.8)	14 (29.8)	1 (11.1)	
Severe	27 (48.2)	22 (46.8)	5 (55.6)	
Very severe	10 (17.9)	8 (17.0)	2 (22.2)	
Comorbidities	29 (51.8)	21 (44.6)	8 (88.8)	0.227

depression do not depend on age of the patient and occur according to the mental condition of the patient. Similarly, VSRQ and TUG were also better in younger group than older group, but it was also statistically nonsignificant. This means VSRQ and TUG depend upon patient's lung condition and not on the age of the patient. Six-minute step test (6MST) performance, reflected by mean strokes performed was significantly better in younger group as compared to older group (337 and 285, respectively) (Table 2).

Table 3 is showing the changes in outcome of PR from baseline to end of 6 months. Both groups showed improvements in all outcomes between baseline and M2, M4 and M6. Some of patients (4) from both groups showed no improvement or even deterioration in M4 and M6 in all parameters.

Figure 1 is showing decreasing mean of total HAD score in both age groups at 2, 4 and end of 6 months and fall of HAD score was more in >70 age group ($p > 0.05$). Figures 2 and 3 are showing improvement in

Table 2. Assessments at Baseline

Baseline	Total group (n = 56)	≤70 years (n = 47)	>70 years (n = 9)	T value	P value
HAD	14.09 ± 3.53	14.00 ± 3.52	14.56 ± 3.78	0.02	0.670
Anxiety	6.41 ± 2.19	6.38 ± 2.11	6.56 ± 2.74	0.51	0.831
Depression	7.68 ± 2.29	7.62 ± 2.25	8.00 ± 2.65	1.76	0.651
VSRQ	43.86 ± 12.48	44.38 ± 12.32	41.11 ± 13.67	0.42	0.476
6MST	311 ± 53	337 ± 56	285 ± 50	2.59	0.01
TUG	20.43 ± 5.54	20.32 ± 5.58	21.00 ± 5.64	0.39	0.739

Table 3. Changes of the Outcomes in M2, M4, M6, after PR According to Age

	≤70 years			>70 years		
	M2	M4	M6	M2	M4	M6
HAD	13.28 ± 3.31	12.34 ± 3.01	11.62 ± 3.02	13.67 ± 3.35	12.89 ± 3.41	11.56 ± 2.96
Anxiety	5.89 ± 1.51	5.81 ± 1.47	5.47 ± 1.54	5.89 ± 1.54	5.44 ± 1.34	5.33 ± 1.58
Depression	7.38 ± 2.41	6.53 ± 1.96	6.15 ± 1.67	7.78 ± 2.64	7.44 ± 2.51	6.00 ± 1.50
VSRQ	51.21 ± 9.89	57.89 ± 7.23	64.89 ± 4.65	50.67 ± 11.49	57.67 ± 8.81	64.11 ± 5.28
6MST	406 ± 65	409 ± 86	448 ± 88	302 ± 56	309 ± 74	328 ± 98
TUG	17.91 ± 5.07	14.45 ± 3.65	11.55 ± 2.61	18.56 ± 4.91	15.22 ± 4.05	12.22 ± 3.15

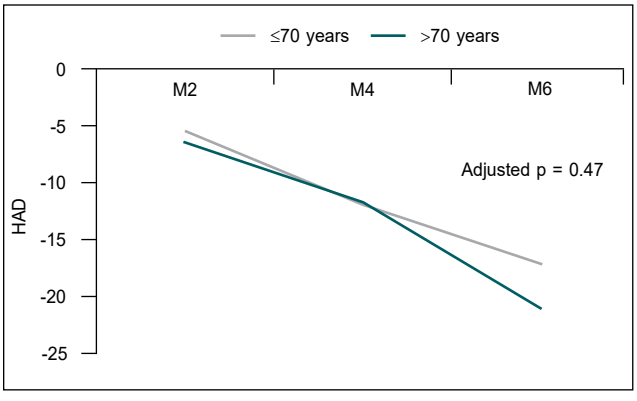

Figure 1. Mean total HAD score in both age groups at M2, M4 and M6.

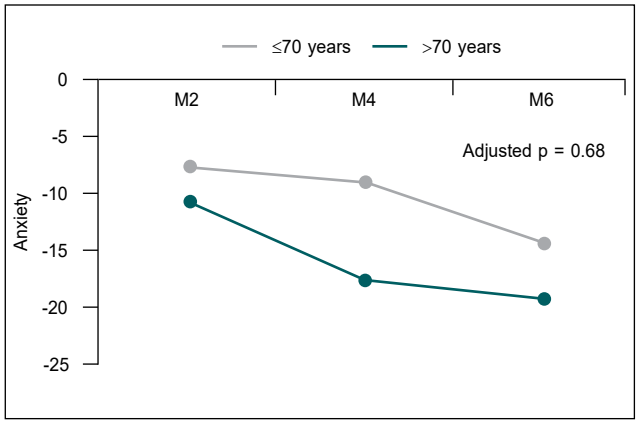

Figure 2. Change in anxiety score at M2, M4 and M6.

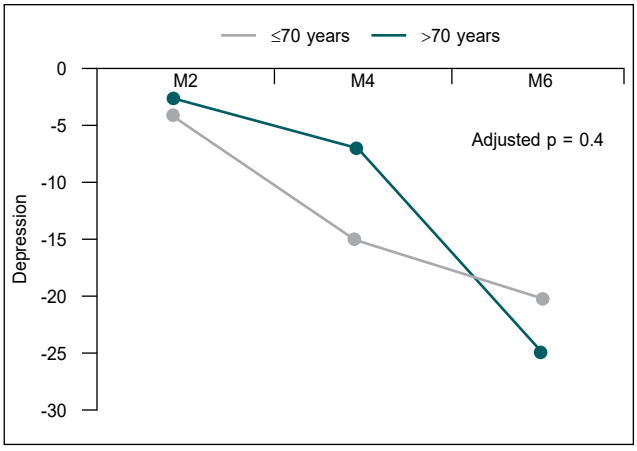

Figure 3. Change in depression score at M2, M4 and M6.

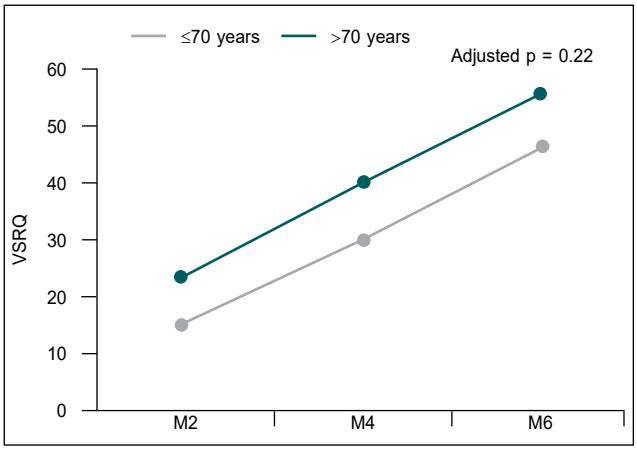

Figure 4. Change in VSRQ at M2, M4 and M6.

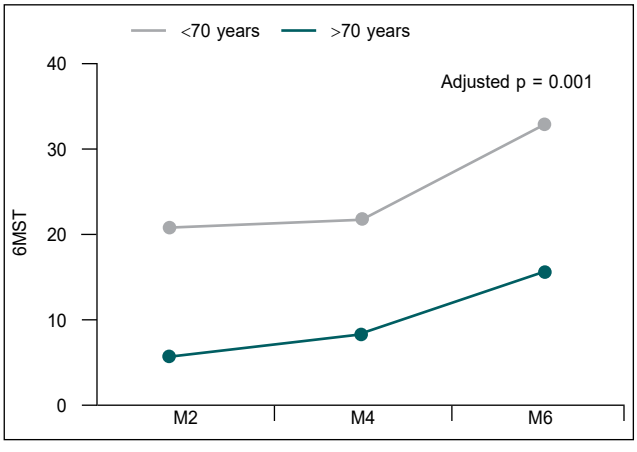

Figure 5. Change in 6MST at M2, M4 and M6.

anxiety and depression scores individually at 2, 4 and end of 6 months of PR. More improvement in anxiety was seen in older age group than younger age group ($p > 0.05$). Similarly, more improvement in depression was seen in older age group than younger age group ($p > 0.05$).

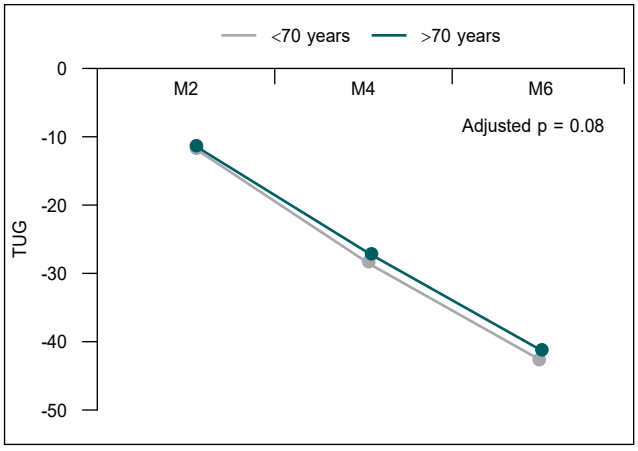

Figure 6. Change in TUG at M2, M4 and M6.

Figure 4 is showing increasing mean of VSRQ scale in both age groups, which means improvement in respiratory conditions of patients occurred in both groups ($p > 0.05$).

Figure 5 is showing increase of 6MST in both groups which indicates the mean number of strokes increased in both age groups and increment was more in younger age group than older age group ($p > 0.05$).

Figure 6 is showing decrease of TUG in both groups, which means the mean time of patient performing TUG became less from baseline to 6 months ($p > 0.05$).

DISCUSSION

The purpose of this study was to observe the effectiveness of home-based PR program at 2, 4 and end of 6 months.

Patients were categorized in two groups: age ≤70 years (younger) and >70 years (older). Out of 56 patients, 47 were in younger and remaining 9 patients were in older group. Dropouts and failure to program are common problems in older patients. In this study, less number of patients were there in older group. This was one of the drawbacks of this study. Out of 16 patients who left the study in between, 12 patients were from older group. Out of total patients, 25 (44.6%) patients were current smoker, 21 patients were from younger group and 4 patients were from older group. Smoking cessation was also prescribed before and during program as smoking can reduce fitness and the ability to perform exercises.[9] In this study, almost half (48.2%) of patients had severe COPD and remaining patients had mild (7.1%), moderate (26.8%) and very severe (17.9%) COPD. Korkmaz Ekren et al did a study and found benefits from PR for mild-to-moderate COPD and suggested that these patients should be included in PR.[10]

At baseline all scores were towards better side in younger group than older group, but they were not comparable, p value was not significant except 6MST parameter, which means younger patients attained more number of strokes than older patients. Anxiety and depression were also less in younger group than older group. A study was conducted by Gephine et al and they observed that anxiety component was high in younger group and depression component was same in both groups. Similarly, VSRQ was also comparable in both groups and TUG was higher in older group.[4] In our study, the number of patients was very less in older group. This may explain the above differences.

In our study, from baseline to end of program, improvement occurred in all parameters in both groups and more improvement occurred in total HAD score, anxiety and depression in older group. According to the study of Gephine et al, improvement was seen in all parameters in younger group but in older group improvement was present in all parameters up to initial 2 months from baseline and thereafter improvement was seen only in total HAD score, anxiety component and depression.[4] In our study, improvement in all parameters was comparable in both groups except 6MST strokes, which was lesser in older group. This difference could be due to higher age as exercise tolerance and fitness are reduced in elder persons as compared to younger individuals.

CONCLUSION

This study concluded that home-based PR was effective as improvement occurred in all parameters and improvement was significant in 6MST strokes from baseline to end of 6-month of program.

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