Section: Pulmonary Medicine

Original Research Article

IMPACT OF PULMONARY REHABILITATION ON EXERCISE CAPACITY, LUNG FUNCTION AND QUALITY OF LIFE IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Background: Chronic obstructive pulmonary disease (COPD) is one of the top three causes of death worldwide. Since COPD is a chronic and progressive disease it produces health related problems as well as economic and social burden to patients and families. In these patients, exercise capacity, health-related quality of life and participation in daily activities are often impaired out of proportion to lung function impairment. Pulmonary rehabilitation is not frequently included in the integrated care of patients and is often inaccessible to patients. **Aim:** To assess the impact of pulmonary rehabilitation on exercise capacity (6 Minute Walk Test), lung function (FEV1) and quality of life in COPD.

Materials and Methods: Sixty patients in the age group 40-80 years who were diagnosed with COPD as per GOLD guidelines were included in this study. Detailed evaluation was done. Pulmonary rehabilitation offered patient education, breathing exercises, chest physiotherapy, and exercise training. A 6MWT, Spirometry (FEV1), SGRQ, BORG dyspnoea scale was assessed initially and after 12 weeks of the programme.

Results: Pulmonary rehabilitation program for 3 months was associated with statistically significant and clinically relevant improvement in physical performance. The mean improvement in 6MWT was 57 meters. Quality of life which was measured by the SGRQ score improved by more than 10 points while the BORG scale dropped significantly from 5.05 to 3.35. The mean FEV1 which was 62.43 at baseline, improved to 62.88 after pulmonary rehabilitation, but the result failed to achieve the desired level.

Conclusion: This study clearly demonstrates that, pulmonary rehabilitation plays a definite role in the management of COPD patients. Outpatient based pulmonary rehabilitation resulted in significant improvement in exercise tolerance, dyspnea scale (BORG) and quality of life; although there was no significant improvement in lung function.

Keywords: 6MWT, COPD, Pulmonary Rehabilitation, Quality of Life.

INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a heterogeneous lung condition characterized by chronic respiratory symptoms (dyspnoea, cough, sputum production, exacerbations) due to abnormalities of the airways (bronchitis, bronchiolitis) and/or alveoli (emphysema) that cause persistent, often progressive, airflow obstruction.[1]

COPD is strongly associated with impaired exercise performance and functional capacity. As the airflow obstruction progresses, COPD patients typically become increasingly sedentary, leading to muscular and cardiovascular deconditioning. The exercise capacity, quality of life (QoL) and participation in activities of daily living are often impaired out of proportion to the lung function impairment.[2]

Aim: To assess the impact of pulmonary rehabilitation on exercise capacity (6 Minute Walk Test), lung function (FEV1) and quality of life in COPD.

MATERIALS AND METHODS

This is prospective observational study conducted at the Department of Respiratory Medicine, in a tertiary care teaching hospital during the period 2020-2021. After approval from the ethical committee and obtaining informed written consent from each patient, 60 patients in the age group 40-80 years, who are diagnosed with COPD as per GOLD guidelines and who met the inclusion criteria (between the age of 55 to 80 years, who attended our pulmonary rehabilitation program for 12 weeks) were included in this study. Patients with significant orthopedic, cardiovascular, neurological comorbidities and with hemodynamic instability were excluded from the study. Detailed evaluation was done. Pulmonary rehabilitation offered included patient education, breathing exercises, chest physiotherapy, and exercise training. A 6MWT, Spirometry (Forced Expiratory Volume in 1 Second, FEV1), SGRQ (St. George's Respiratory Questionnaire), and BORG dyspnea scale was assessed initially and after 12 weeks of the program. After collecting the data, it was analyzed using SPSS statistical package. Paired t test was used to compare the effect of outpatient based pulmonary rehabilitation on exercise capacity, dyspnea and quality of life in stable COPD patients. For all statistical interpretations, $p < 0.05$ was considered the threshold for statistical significance.

RESULTS

All 60 patients completed the study and were available for data analysis. Of these 60 patients, 40 (66.7%) were males and the rest 20 were females. The various tests used to assess the efficiency of pulmonary rehabilitation program were compared using t tests. Paired sample statistics demonstrated clear improvements in functional capacity, symptoms, and quality of life following pulmonary rehabilitation. The mean 6-minute walk test (6MWT) distance increased from 253.95m pre-rehabilitation to 310.05m post-rehabilitation. Scores on the St. George's Respiratory Questionnaire (SGRQ) showed a reduction from 80.55 to 69.97, indicating improvement in health-related quality of life. The mean BORG dyspnea score decreased from 5.05 to 3.35, reflecting reduced perceived breathlessness. In contrast, FEV_1 showed only a minimal change, increasing from 62.43 to 62.88, suggesting limited effect on pulmonary function. Paired sample correlations indicated strong, statistically significant correlations between pre and post-intervention measurements for all parameters ($r = 0.802–0.999$, $p < 0.001$), demonstrating consistency in patient responses across assessments.

Paired differences revealed significant improvements in most clinical outcomes. The 6MWT distance increased by an average of 56.10 m, and SGRQ scores improved by 10.58 points, both of which were statistically significant. BORG scores decreased by 1.70 points, also achieving statistical significance. The mean change in FEV_1 (−0.45) was small and did not reach statistical significance. The paired t-test analysis confirmed these findings. Significant differences were observed for 6MWT ($p < 0.001$), SGRQ ($p < 0.001$), and BORG scores ($p < 0.001$), whereas the change in FEV_1 was not statistically significant ($p = 0.114$).

The mean 6-minute walk test value changed from 253.95 m to 310.05 m after pulmonary rehabilitation the result was significant at a p value of < 0.05. St George's Respiratory Questionnaire score (SGRQ) dropped significantly from the pre pulmonary rehabilitation value of 80.55 to 69.97 post rehabilitation. The finding was significant at a p value of < 0.05

The mean forced expiratory volume in 1 second (FEV1 %) was 62.43 at baseline after pulmonary rehabilitation the mean FEV1% improved to 62.88. But the result failed to achieve the desired level of significance. The Pre rehabilitation BORG scale score dropped significantly from 5.05 to 3.35 at a p value of < 0.05.

Table 1: Paired sample test

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PreRb 6MWT	253.95	60	98.053	12.659
	PostRb 6MWT	310.05	60	110.793	14.303
Pair 2	PreRb SGRQ	80.55	60	38.845	5.015
	PostRb SGRQ	69.97	60	40.640	5.247
Pair 3	PreRb FEV1	62.43	60	42.270	5.457
	PostRb FEV1	62.88	60	42.224	5.451
Pair 4	PreRb BORG	5.05	60	1.032	.133
	PostRb BORG	3.35	60	.880	.114

Paired sample statistics demonstrated clear improvements in functional capacity, symptoms, and quality of life following pulmonary rehabilitation. The mean 6-minute walk test (6MWT) distance increased from 253.95 m pre-rehabilitation to 310.05 m post-rehabilitation. Scores on the St. George's Respiratory Questionnaire (SGRQ) showed a reduction from 80.55 to 69.97, indicating improvement in health-related quality of life. The mean BORG dyspnea score decreased from 5.05 to 3.35, reflecting reduced perceived breathlessness. In contrast, FEV_1 showed only a minimal change,

increasing from 62.43 to 62.88, suggesting limited effect on pulmonary function.

Table 2: Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PreRb 6MWT & PostRb 6MWT	60	.955	.000
Pair 2	PreRb SGRQ & PostRb SGRQ	60	.993	.000
Pair 3	PreRb FEV1 & PostRb FEV1	60	.999	.000
Pair 4	PreRb BORG & PostRb BORG	60	.802	.000

Paired sample correlations indicated strong, statistically significant correlations between pre and post-intervention measurements for all parameters ($r = 0.802–0.999$, $p < 0.001$), demonstrating consistency in patient responses across assessments.

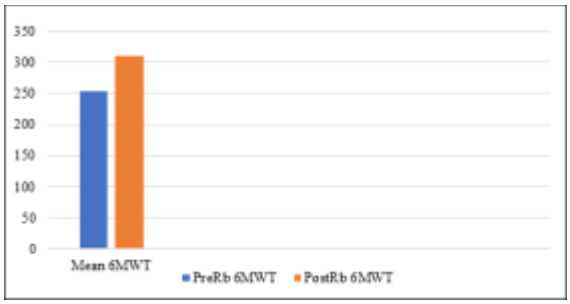

Figure 1: Change in 6MWT

The mean 6-minute walk test value changed from 253.95 m to 310.05 m after pulmonary rehabilitation the result was significant at a p value of < 0.05.

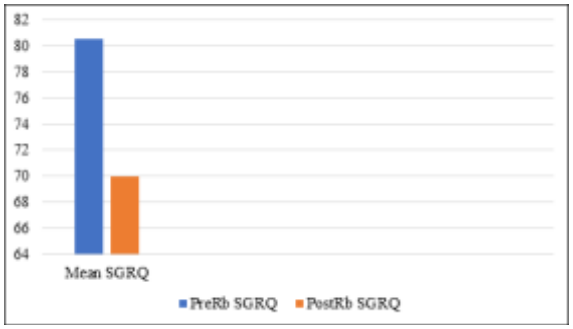

Figure 2: Change in SGRQ Score

St George's Respiratory Questionnaire score (SGRQ) dropped significantly from the pre pulmonary rehabilitation value of 80.55 to 69.97 post rehabilitation. The finding was significant at a p value of < 0.05.

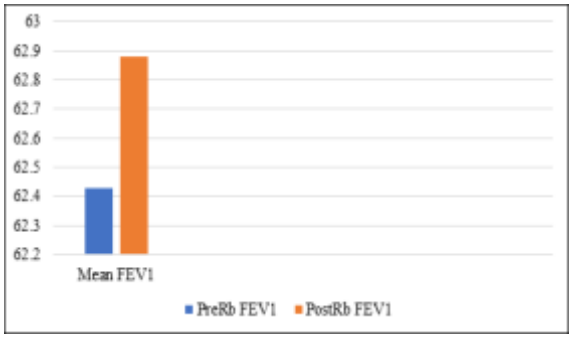

Figure 3: Change in FEV1

The mean forced expiratory volume in 1 second (FEV1 %) was 62.43 at baseline after pulmonary rehabilitation the mean FEV1% improved to 62.88. But the result failed to achieve the desired level of significance.

Change in BORG Scale:

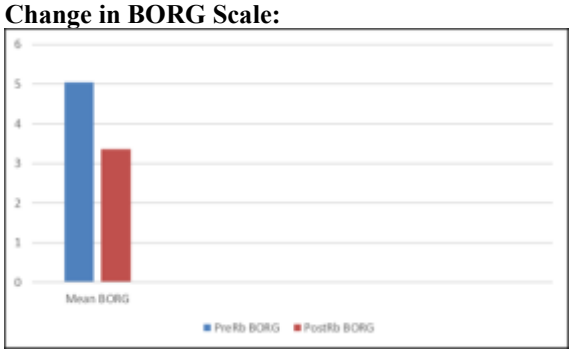

Figure 4: Change in BORG scale

The Pre rehabilitation BORG scale score dropped significantly from 5.05 to 3.35 at a p value of < 0.05.

DISCUSSION

Chronic obstructive pulmonary disease (COPD) is a common disease and a common cause of mortality and morbidity.[3] Exercise intolerance is a characteristic and a troubling manifestation of this disease. Loss of physical capacity and the adverse psychological effects of COPD contribute greatly to morbidity. People suffering from severe forms of this disease usually spend their remaining years of life in bed and have declining quality of life. Exercise intolerance is a characteristic and a troubling manifestation of this disease. Loss of physical capacity and the adverse psychological effects of COPD contribute greatly to morbidity. Medicines have limited role in improving physical capacity of these patients. People suffering from severe forms of this disease usually spend their remaining years of life in bed and have declining quality.[4] In this prospective study done in patients with COPD over a period of 12 months a total of 60 patients who met the criteria were screened. All these patients had moderate to severe pulmonary impairment with markedly reduced exercise tolerance and quality of life with optimum medical management. In our study, 66.7% patients were males and 33.3% were females. In their study, C. Raherison et al reported that COPD affects twice as many males as females, a finding similar to the present results.[5] The mean age of the study group was 68.7 years with participants as

young as 61 years to 81 years included. Similar finding was reported by K E holm et al where the age ranged from 32 years to 84 years.[6] In the study group, a pulmonary rehabilitation program for 3 months, was associated with statistically significant ($p < 0.05$) and clinically relevant, improvement in physical performance. The mean improvement in 6MWT in our study was 57 meters, a finding reflected in the study by Rainer Gloeckl et al where the change was + 44 meters.[7] In their study, Shahin Barakat et al reported a mean increase in 6MWD of more than 54 m in the rehabilitation group after 14 weeks, which was significantly greater than the mean change in the control group ($p < 0.05$).[8]

The SGRQ score in our study improved by more than 10 points, which was consistent with the metanalysis findings where the SGRQ score was reported in 25 studies when pulmonary rehabilitation showed a significant improvement in the quality of life according to the altered SGRQ total score (WMD, −6.66; 95% CI: −8.38 to −4.94; $p < 0.001$; $I2 = 78\%$). In 2001, Virendra Singh et al demonstrated a significant increase in 6MWD with a P value < 0.001, following a 4 week pulmonary rehabilitation.[4]

In our study, the mean forced expiratory volume in 1 second (FEV1) was 62.43 at baseline after pulmonary rehabilitation, the mean FEV1 improved to 62.88 but the result failed to achieve the desired level of significance. Cheriamane D et al in 2013 conducted randomized control study in 100 patients, which showed no change in pulmonary function parameters at the end of 6 weeks pulmonary rehabilitation programme.[9] The Pre rehabilitation BORG scale score in our study, dropped significantly from 5.05 to 3.35 at a p value of <0.05. These findings correlate with the study conducted by O'Donnell et al, which demonstrated that dyspnea and fatigue measured with a BORG scale, during guided cycle exercise, decreased significantly in the pulmonary rehabilitation group.[10]

Our study has demonstrated a statistically significant improvement in exercise tolerance and QoL following an outpatient based PRP. This study is consistent with previous reports, showing that a PRP for COPD patients encompassing education, breathing retraining, and chest physiotherapy followed by exercise training leads to functional exercise capacity and health related quality of life. The improvement in exercise tolerance and quality of life following an outpatient based PRP can be ascribed to aerobic capacity of muscle strength, increased motivation, increased adherence to treatment, desensitization to sensation of dyspnoea, improved ventilatory muscle function and improved technique of performance.

CONCLUSION

Looking at the increasing burden of COPD patients in developing countries, there is an urgent need of advocacy of pulmonary rehabilitation in complete management of this disease. Despite its proven effectiveness and the strong scientific recommendations for its routine use in the care of COPD, pulmonary rehabilitation is generally underutilized and strategies for increasing access to rehabilitation services are needed. The present study, demonstrates that simple outpatient based pulmonary rehabilitation in a tertiary care hospital resulted in significant improvement in Quality of life, exercise capacity, after pulmonary rehabilitation programme. The overall benefits of outpatient Pulmonary rehabilitation programme takes into consideration-optimization of and improved adherence to the medical regimen, smoking cessation, the educational component and increased frequency of interaction with health-care providers.

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