Effectiveness of Multidimensional Pulmonary Rehabilitation in Improving Clinical Outcomes and Functional Capacity in COPD Patients

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Abstract-This study evaluates the impact of a multidimensional pulmonary rehabilitation program on clinical outcomes, functional capacity, and quality of life in COPD patients. A prospective observational study was conducted at JLN Medical College, Ajmer, Rajasthan, involving 30 COPD patients over a period of two months. Statistically significant improvements were observed in respiratory rate (p=0.001), Borg dyspnea scale (p=0.001), and six-minute walk test (p=0.04). Additionally, pulmonary function measures, including post-bronchodilator FEV1 (p=0.03), improved significantly. The study concludes that pulmonary rehabilitation significantly enhances COPD patients' clinical and functional outcomes.

I. Introduction

Chronic obstructive pulmonary disease (COPD) isa major cause of morbidity and mortality globally characterized by persistent respiratory symptoms and airflow limitation that is due to airway and/or alveolar abnormalities usually caused by significant exposure to noxious particles or gases. In 1990, the World Health Organization (WHO) Global burden of disease study showed that the COPD was the 6th leading cause of death worldwide. At present COPD ranks fourth leading cause of mortality.[1]

Pulmonary rehabilitation (PR) is defined as a multidisciplinary programme of care for patients with chronic respiratory impairment that is individually tailored and designed to optimize each patient's physical and social performance and autonomy.[2]It has emerged as an effective interventionintegrating exercise training, education, and behavioural changes to enhance patient's quality of life.Currently it has been established that the functional abnormalities observed in COPD patients are largely irreversible. The damaged lung

will continue to exhibit accelerated aging losses in function even though no further injury is sustained.[3] Thus the best, one might hope to achieve through rehabilitation is bringing down the loss of FEV_1 of the patients with COPD to the normal loss rate of 25 to 30 ml per year in comparison to a loss rate of 50 to 100 ml per year in an un rehabilitated condition.[4] So, our study aims to assess the effectiveness of PR on pulmonary functional measures and exercise capacity in COPD patients.

II. Aim & Objectives

1. Evaluate the impact of PR on pulmonary function measures (FEV1, FVC, and FEV1/FVC ratio, PEFR).

2. Assess changes in the six-minute walk test (6MWT) and subjective breathlessness scores.

3. Investigate the relationship between PR effectiveness and disease severity.

III. Materials and Methods

The prospective observational study was conducted at Department of Respiratory medicine, JLN Medical College Ajmer (Rajasthan) with 30 patients during august 2016- October 2017. Before initiating the study, we got permission from ethical committee of the institution to carry out the study.An evaluative approach was employed to find out the effectiveness of pulmonary rehabilitation, specifically exercises on pulmonary functional measures and exercise capacity of patients with chronic obstructive pulmonary disease. Patients suffering from COPD (FEV1/FVC less than 70% of actual measured values and the FEV1 less than 80% of predicted value) of age group 35 years or more living in or near to ajmer and willing to quit smoking were included in this study while patients who have/had Tuberculosis and/or AIDS, Cardiac and other systemic diseases, Neuromuscular disorders, Any chest or physical deformityalong with COPD or not willing to quit smoking were excluded from this study.The assessment includes pre-and post-rehabilitation evaluation (before starting the exercise program i.e at o month, at the end of one month and at the end of two months)of pulmonary functions, respiratory rate, Borg dyspnea scale, and 6MWT.

IV. Results

The mean age of the patients was 60.66 ± 5.78 (mean ± SD) years and the age of the patients ranged between 49 and 72 yrs.The comparison of respiratory rate at different time interval shows that the mean respiratory rate at 0 month was 20.83 ± 2.01, at end of 1 month was 18.33± 1.47 and at end of 2 months was 16.76 ± 2.23

and p value =0.001 (significant). The improvement was statistically significant (p value =0.001).

The comparison of Borg dysnea scale at different time intervals shows that the mean Borg dyspnea scale at 0 month was 15.73 ± 1.08, at end of 1 month was 13.56± 1.104 and at end of 2 months was 11.73 ± 2.03. The improvement was statistically significant (p value=0.001).

The % predicted of mean Pre-Bronchodilator FVC at 0 month was 48.5± 7.02, at end of 1 month was 50.83± 7.13 and at end of 2 months was 52.53 ± 6.92 and p value =0.08 (non-significant). So the Pre Bronchodilator FVC showed statistically non-significant changes during the study.The % predicted of mean Post Bronchodilator FVC at 0 month was 53.00± 6.97 , at end of 1 month was 55.03± 6.89 and at end of 2 months was 56.76 ± 7.06 and p value =0.11 (non-significant). So the Post Bronchodilator FVC showed statistically non-significant changes during the study.

The % predicted of mean Pre-Bronchodilator FEV1 at 0 month was 39.93± 5.47, at end of 1 month was 41.9± 5.955 and at end of 2 months was 43.73 ± 6.448. The improvement was statistically significant (p value=0.05).The % predicted of mean Post Bronchodilator FEV1 at 0 month was 42.63± 5.53 , at end of 1 month was 44.76± 5.957 and at end of 2 months was 46.53 ± 6.312 and p value =0.04 (significant). The improvement was statistically significant (p value=0.04).There was no statistically significant improvement in Pre and Post Bronchodilator % predicted FEV1 at end of 1 month as compared to 0 month and at end of 2nd month as compared to 1month but improvement was statistically significant in Pre and Post Bronchodilator % predicted FEV1at end of 2nd month as compared to 0 month (p value=0.04 and 0.03).

The mean Pre-Bronchodilator FEV1/FVC ratio at 0 month was 0.47± 0.058, at end of 1 month was 0.49±0.057 and at end of 2 months was 0.51 ±0.059 and p value =0.07 (non-significant). The Pre-Bronchodilator FEV1/FVC improved but statistically non-significant (p value=0.07).The mean Post Bronchodilator FEV1/FVC ratio at 0 month was 0.49± 0.059 , at end of 1 month was 0.51± 0.058 and at end of 2 months was 0.53 ± 0.05 and p value =0.04 (significant). The improvement was statistically significant (p value=0.04).

The % predicted of mean Pre-Bronchodilator PEFR at 0 month was 16.6± 3.31, at end of 1 month was 18.23± 3.28 and at end of 2 months was 19.6 ±

3.17 and p value =0.003 (significant). The improvement was statistically significant (p value=0.003). The mean Post Bronchodilator PEFR at 0 month was 19.06± 3.55 , at end of 1 month was 20.66± 3.47 and at end of 2 months was 22.13 ± 3.501 and p value =0.005 (significant). The improvement was statistically significant (p value=0.005).

When 6MWT was compared in different time interval, it was indicated that the mean distance covered in 6 minutes at 0 month was 288.43± 64.01, at end of 1 month was 308.30± 66.83 and at end of 2 months was 331.63 ± 68.18 and p value =0.04 (significant). The improvement was statistically significant (p value= 0.04). The mean SPO_2 at at 0 month was 90.3± 2.01, at end of 1 month was 91.2± 1.82 and at end of 2 months was 91.6 ± 1.75 and p value =0.02 (significant). The improvement was statistically significant (p value= 0.02).

V. Summary &Conclusion

This study was conducted at JLN Medical college ajmer on 30 COPD patients with the approval of institutional ethics committee. In this study it was observed that after using the exercise program of pulmonary rehabilitationthere was a significant improvement in respiratory rate (p=0.001) and borg dyspnoea scale (p=0.001). An increase in 6MWT distance (p=0.04) indicating enhanced functional capacity was also observed after 2 months of exercise programme .Post-bronchodilator FEV1 also improved significantly (p=0.03). so after this study , it was concluded that Pulmonary rehabilitation significantly enhances pulmonary function, exercise capacity, and quality of life in COPD patients. Future research should focus on long-term sustainability and integrating tele-rehabilitation.

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