



## THE EFFECT OF PULMONARY REHABILITATION ON EXERCISE CAPACITY AND QUALITY OF LIFE IN PATIENTS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE

**Ravi Mishra**

Pg 3 Deptt Of Pulmonary Medicine R D Gardi Medical College and Hospital Ujjain Mp

**Dayashankar Parauha**

Director Department of Medicine and Critical Care Vhrc Rewa. H No. 66 Shilpi Kamta Padra Rewa MP - Correspondence Author

### ABSTRACT

**Background.** Recent research shows that pulmonary rehabilitation (PR) programmes in patients of chronic obstructive pulmonary disease (COPD), reduced dyspnoea, improved exercise capacity, and prevented occurrence of further exacerbations.

**Objective.** To evaluate the utility of a 12-week PR programme in patients with COPD.

**Methods.** Patients with COPD, were evaluated for baseline and after the end of pulmonary rehabilitation. Baseline assessment included spirometry, six-minute walk test (6MWT), symptom limited cardiopulmonary exercise test (CPET), health-related quality of life (HRQoL) assessment by generic questionnaire medical outcomes study short form (S-F 36) questionnaire and dyspnoea evaluation by Borg score. The study group patients were treated with usual care plus PR exercises in the form of 20 minutes each of walking, bicycle ergometry and resistance exercises, thrice-weekly for 12 weeks.

The assessment was repeated in study group after 12 weeks.

**Results:** Sessions of PR exercises produced statistically significant improvement in general well-being, forced expiratory volume in the first second (FEV1), 6MWT parameters, exercise capacity.

**Conclusion.** PR programmes appear to be helpful in the management of COPD.

**KEYWORDS :** Pulmonary rehabilitation, COPD, Cardiopulmonary exercise test, 6MWT.

**Introduction:** Chronic obstructive pulmonary disease (COPD) is an inflammatory disease of lungs and pulmonary vessels, With destruction of alveolar septa and enlargement of Air-spaces, characterised by progressive airflow limitation which is not fully reversible. There are Persistent symptoms of cough, expectoration, wheezing And progressive dyspnoea, which is further accentuated

By static and dynamic hyperinflation of lungs. As the Disease advances, ventilation/perfusion mismatch Results in hypoxaemia, respiratory acidosis, pulmonary Hypertension and heart failure, culminating in death.<sup>1,2</sup>

COPD is also complicated by profound systemic Effects.<sup>3,5</sup> High levels of circulating proinflammatory Cytokines produce a chronic catabolic state in 20%-40% Patients, resulting in weight loss, skeletal muscle wasting And chronic fatigue; a low body mass index (BMI; Kg/m<sup>2</sup>) Is an independent predictor of mortality. Deconditioning And weakness of respiratory muscles adversely affect Pulmonary disability and promote respiratory failure. An official statement from the American Thoracic Society (ATS) in 1999, further reinforced by ATS/ European Respiratory Society (ERS),<sup>6</sup> advocated pulmonary rehabilitation (PR) as a "multi-disciplinary programme of care for patients with chronic respiratory impairment that is individually tailored and designed to optimise physical and social performance and autonomy". All COPD patients, including those after acute exacerbations, appear to benefit from PR programmes with significant improvement in exercise tolerance and relief from dyspnoea and fatigue (Evidence level A).<sup>7</sup> The available data from several studies suggest that improved physical endurance occurs even after a single PR programme,<sup>8,9</sup> if exercise training is maintained at home. present study was undertaken to evaluate the effect of Pulmonary rehabilitation on COPD patient's exercise capacity and quality of life (QOL) residing mainly in rural areas.

### Material and method:

The present study was carried out in the department of pulmonary medicine At R D Gardi Medical College And Hospital. As per the guidelines of the Indian

Council of Medical Research on Biomedical Research on Humans, as well as the mandatory practice of the hospital, the patient or his/her

legal guardian was explained the purpose and procedures to be used in the study. Informed consent was also taken in writing.

All COPD patients attending routine OPD were given usual treatment as per the standard protocol,<sup>1</sup> including conventional chest physiotherapy with postural drainage, huffing and coughing, diaphragmatic breathing, and inhaled bronchodilators.

The inclusion criteria consisted of: COPD –GOLD stage II to IV<sup>1</sup>; either gender; age 40 – 70 years; currently non-smoker; no history of atopy and a firm commitment to co-operate through the study period. Patients with evidence of persistent sepsis, haemoglobin less than 10 g/dL, heart or renal failure, tuberculosis or lung cancer were excluded. Relevant findings of in-depth clinical history and thorough physical examination were recorded. Laboratory investigations included, chest radiograph, routine tests and arterial blood gas analysis. Special investigations included: spirometry with Morgan Spiro as per the ATS guidelines<sup>10</sup>; assessment of functional exercise capacity by six minute walk test (6MWT)<sup>11</sup> and maximal exercise capacity by symptom limited cardio-pulmonary exercise testing (CPET);<sup>12</sup> HRQoL by generic questionnaire medical outcomes study short form (SF-36)<sup>13</sup> and dyspnoea assessment on modified Borg scale.<sup>14</sup>

### Results:

This prospective study was carried out in patients with COPD over a period of 1.5 years. A total of 227 patients who met the inclusion criteria were screened including 206 males and 21 female. All these patients had mild to severe COPD were divided on basis of combined COPD assessment with reduced exercise tolerance and quality of life with optimum medical management.

Seventy one patients who met the inclusion criteria completed the PRP of which 57 were males and 14 were females. The remaining 156 patients dropped out of the PRP. In our study, most of dropouts of regular PRP were not of medically related reasons, but were due to illiteracy, lack of knowledge, lack of adherence to drugs, and far location from the hospital as it is a rural based set up and patients are mainly from low socio-economic areas.

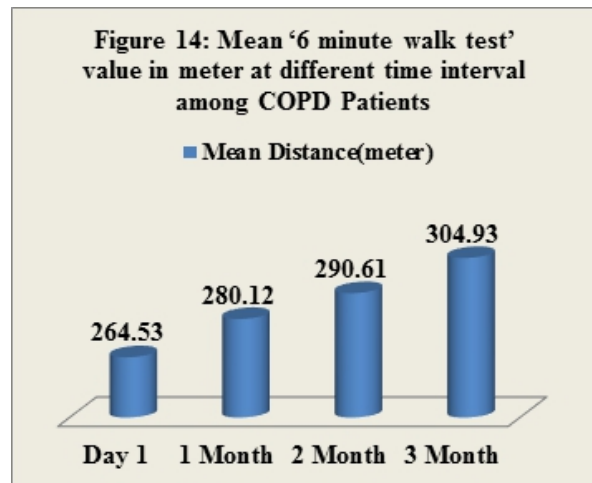
As we classified our patients on basis of combined COPD

assessment in A,B,C,D groups the maximum number of hospital admissions were found in C&D group. It is also observed that Rate of Hospitalization was seen more in 61-70 year old patients.

**Table no.1:** Distribution of study subject according to COPD Severity&gender.

COPD Severity	MALE N(%)	FEMALE N(%)	TOTAL N(%)	Chi Square Value	Significance "P" Value
A	14(19.7%)	1(1.4%)	15(21.1%)	2.986	0.394(NS)
B	17(23.9%)	4(5.6%)	21(29.6%)		
C	11(15.5%)	5(7.0%)	16(22.5%)		
D	15(21.1%)	4(5.6%)	19(26.8%)		

Chronic obstructive pulmonary disease is characterized by an accelerated decline in FEV1. At the end of the PRP, there was mild improvement in FEV1 as Before Pulmonary Rehabilitation FEV1 was 49.65% ±20.76 and after pulmonary rehabilitation it was increased to 50.25 %±21.12. Mean % Change was 1.21% in COPD patients. In the present study, PRP led to improvement in the 6 min walking distance in all the patients with COPD as Before pulmonary rehabilitation on day 1 it was 264.53 ± 98.15 meter and after pulmonary rehabilitation, it was continuously increasing and after three month it was increased to 304.93 ± 97.83 meter i.e. there is mean increase of 40.4 m in all groups. The minimum clinically important difference for the 6MWT has been estimated to be 30 m.



The COPD Assessment test (CAT) is a recently introduced instrument to assess health-related quality of life in COPD. We aimed to evaluate the longitudinal change in CAT following Pulmonary Rehabilitation Program (PRP) in short term of 3 months. During PRP total CAT score found continuously decreasing in subsequent follow-up from day 1 to end of 3 month in all groups. Borg scale is a category scale used to measure exertional and overall dyspnea. In all the patients, there was a significant decrease in the dyspnea. There was not much change seen in mMRC grade after Pulmonary Rehabilitation. Only mMRC Grade 4 was present in 8 patients before PRP and after Pulmonary Rehabilitation it reduced to mMRC grade 3 in 4 patients.

**Table no 2:** Mean Dyspnoea on Modified Borg Scale (0-10) before & after pulmonary rehabilitation at different time interval among COPD Patients.

Dyspnoea Borg score	Day 1	1 Month	2 Month	3 Month
MEAN	6.65	4.55	3.69	3.21
SD	1.829	2.215	2.297	2.563
MEDIAN	6.00	4.00	3.00	2.00
Repeated Measure of ANOVA	333.711			
Significance "P" Value	0.001(HS)			

In our study, after PRP we observed mean increase of 1 kg weight in

patients of COPD.It was found that there was improved compliance to treatment with PRP thus reducing risk of exacerbations.

**Table 3:** Modified medical research council (MMRC) grade before & after pulmonary rehabilitation.

MMRC GRADE	Pre Pulmonary Rehabilitation		Post Pulmonary Rehabilitation	
	NUMBER	PERCENTAGE	NUMBER	PERCENTAGE
0 Zero	0	0.0%	3	4.2%
1 One	21	29.6%	21	29.6%
2 Two	23	32.4%	23	32.4%
3 Three	19	26.8%	20	28.2%
4 Four	8	11.3%	4	5.6%

**Discussion:**

The results of the present study clearly demonstrate that add-on therapy with PR programmes even of short duration play a definite role in the management of COPD patients. It definitely improves capacity and duration of exercise as well as general QoL of patients. The treatment modalities available for stable COPD are not entirely satisfactory as these not only fail to arrest the progression of disease and the accompanying disability, but also do not provide adequate relief of symptoms. The problem is further compounded with the development of systemic effects of the disease resulting in loss of weight, skeletal and respiratory muscle dysfunction with increasing disability and recurrent acute exacerbations. In the absence of specific anti-inflammatory therapy against COPD, a holistic approach to its management is the best option. In addition to the well-established treatment regimens with antibiotics, bronchodilators and corticosteroids,<sup>15</sup> administration of PR programmes is a relatively newer concept, Such programmes are conventionally administered during a period of clinical stability, for six weeks or longer, followed by continued exercises at home for sustained effect.<sup>16</sup> Only a few studies have reported on the effects of 3-4-week duration programmes on stable COPD patients with varying results. It is noteworthy that inpatient PR programmes of two-week duration have been shown to produce significant improvement in exercise capacity.<sup>17</sup> Recently, administration of PR programmes has been shown to provide significant clinical benefits during or immediately after an acute exacerbation.<sup>18, 19-21</sup> In India the treating respiratory physicians do not seem to be aware of the benefits of PR as add-on therapy. A practical problem, however, is that to ensure better compliance by the patient, the duration of an effective PR programme needs to be as short as possible. There are several other issues which would influence the outcome of the PR programmes. Compliance by the patient is always difficult to achieve, especially when regular exercise at home for at least 20 minutes daily is mandatory to sustain the functional improvement achieved through PR. Issues related to malnutrition that is common especially in older individuals, use of supplementary oxygen need to be addressed. Other co-morbidities, especially diabetes, anxiety, depression and other mental health disorders must be promptly diagnosed and appropriately treated. Regular administration of pharmacotherapy to reduce the impact of airflow limitation is absolutely vital for successful implementation of PR programmes. Frequent counselling of patients including self management education also forms an integral part of COPD management. A recent multi-centric randomized clinical trial, has provided evidence that a multicomponent, skill oriented self management programme- including an exacerbation action plan - reduced hospitalisations, emergency visits and improved HRQoL. These claims, however, were not substantiated in another comparable randomised study. The beneficial effects of PR, i.e., symptom relief, improved physical endurance and enhanced HRQoL start declining towards baseline after 6-12 months of the PR programme.<sup>22</sup> Strategies to maintain the benefits of PR are yet not clear and more research in this area is needed. The management problems are population specific and the results of investigations carried out in other countries should not be extrapolated to Indian population in toto.

**References:**

1. Global Initiative for Chronic Obstructive Lung Disease. Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease – 2006. Available at URL: <http://www.goldcopd.com>. Accessed on February 21, 2014.
2. Khirani S, Poese G, Morlini G, Rossi A. Pathophysiology of airflow limitation in COPD. In: Cazzola M, Celli B, Dahl R, editors *Therapeutic Strategies in COPD*. Oxford: Clinical Publishing Oxford; 2005:p.27-46.
3. Wouters EFM. Chronic obstructive pulmonary disease. 5: Systemic effects of COPD. *Thorax* 2002;57:1067-70.
4. Engelen MPKJ, Schols AMWJ, Baken WC, Wesseling GJ, Wouters EFM. Nutritional depletion in relation to respiratory and peripheral skeletal function in out-patients with COPD. *Eur Respir J* 1994;7:1793-7.
5. Schols AMWJ, Slangen JOS, Volovics LEX, Wouters EFM. Weight loss is a reversible factor in the prognosis of chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1998;157:1791-7.
6. American Thoracic Society/European Respiratory Society Statement on Pulmonary Rehabilitation. *Am J Respir Crit Care Med* 2006;173:1390-1413.
7. Berry MJ, Rajeski WJ, Adair NE, Zaccaro D. Exercise rehabilitation and chronic obstructive pulmonary disease stage. *Am J Respir Crit Care Med* 1999;160:1248-53.
8. Puhan MA, Gimeno-Santos E, Scharplatz M, Troosters T, Walters EH, Steurer J. Pulmonary rehabilitation following exacerbations of chronic obstructive pulmonary disease. *Cochrane Database Sys Rev* 2011(10):CD005305.
9. Foglio K, Bianchi L, Bruletti G, Battista L, Pagani M, Ambrosino N. Long term effectiveness of pulmonary rehabilitation in patients with chronic airway obstruction. *Eur Respir J* 1999;13:125-32.
10. Miller MR, Hankinson J, Brusasco V, Burgos F, Casaburi R, Coates A, et al. In: *Standardisation of Spirometry*. Ed Brusasco V, Crapo R, and Viegi G, Nr 2 in this Series "ATS/ ERS Task Force: Standardisation of lung function testing". *Eur Respir J* 2005;26:319-38.
11. American Thoracic Society Statement: Guidelines for the sixminute walk test. *Am J Respir Crit Care Med* 2002;166:111-7.
12. American Thoracic Society / American College of Chest Physicians statement on cardiopulmonary exercise testing. *Am J Respir Crit Care Med* 2003;167:211-77.
13. Ware JEJ, Sherbourne CD. The MOS 36-item short-form health survey (SF – 36). Conceptual framework and item selection. *Med Care* 1992;30:473-83.
14. Borg GAV. Psychological basis of perceived exertion. *Med Sci Sports Exerc* 1982;14:377-81.
15. Global Initiative for Chronic Obstructive Lung Disease. Global Strategy for the Diagnosis, Management and Prevention of Chronic Obstructive Pulmonary Disease. GOLD 2011.
16. Yerg JE, Seals DR, Hagberg JM. Effect of endurance training on ventilatory function in older individuals. *J Appl Physiol* 1985;58:791-4.
17. Cini E, Foglio K, Bianchi L, Porta R, Vitacca M, Ambrosini N. In-hospital short term training program for patients with chronic airway obstruction. *Chest* 2001;120:1500-5.
18. Man WD, Polkey MI, Donaldson N, Gray BJ, Moxham J. Community pulmonary rehabilitation after hospitalization for acute exacerbations of chronic obstructive pulmonary disease: randomized controlled study. *BMJ* 2004;329:1209-11.
19. Puhan MA, Scharplatz M, Trusters T, Steurer J. Respiratory rehabilitation after acute exacerbation of COPD may reduce risk for readmission and mortality: a systematic review. *Respir Res* 2005;6:54.
20. Behnke M, Jorres RA, Kirsten D, Magnussen H. Clinical benefits of a combined hospital and home - based exercise program for over 18 months in patients with severe COPD. *Monaldi Arch Chest Dis* 2003;59:44-51.
21. Behnke M, Taube C, and Kirsten D, Lehnigk B, Jorres RA, Magnussen H. Home - based exercise is capable of preserving hospital – based improvements in severe chronic obstructive pulmonary disease. *Respir Med* 2000;94:1184-91.
22. Bestall JC, Paul EA, Garrod R, Graham R, Jones PW, Wedzicha JA. Longitudinal trends in exercise capacity and health status after pulmonary rehabilitation in patients with COPD. *Respir Med* 2003;97:173-80.