e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2023; 15(11); 804-809

Original Research Article

Impact of Pulmonary Rehabilitation on Pulmonary Function and Quality of Life in Individuals with Chronic Respiratory Diseases

Vaibhav Shankar

Consultant, Department of Pulmonary Medicine, Holy Promise Hospital, Patna, Bihar, India

Received: 12-09-2023 / Revised: 13-10-2023 / Accepted: 25-11-2023
Corresponding Author: Dr. Vaibhav Shankar
Conflict of interest: Nil

Abstract

Aim: To assess the influence of pulmonary rehabilitation on pulmonary function and quality of life in individuals with chronic respiratory diseases

Materials and Methods: This study was conducted in the Department of Pulmonary Medicine, Holy Promise Hospital, Patna, Bihar, India for one year. A total of 80 patients with diagnosed chronic respiratory disease were referred for pulmonary rehabilitation. Out of these 40 patients enrolled into the program. Patients with clinically stable mild to moderate obstructive & restrictive condition were included in the study. The diagnosis lung disease was based on the pulmonary function test with detailed history & HRCT. As a prerequisite to enrollment, all patients underwent a detailed assessment of clinical history, investigation, and comorbidity status assessment by a Pulmonologist by any other fraternity physicians were needed. A written informed consent was obtained. The study population included 14 male and 26 females. With the mean age of 56.3 13.6. The outcome measures namely quality of life (LCADLS), aerobic capacity (6MWTD), and MRC grade, functional capacity (PFT) was assessed in these patients when they enrolled into the program (0 week) and at the end of the program (8 week).

Results: A total 80 patients were referred for pulmonary rehabilitation at pulmonary rehabilitation department, 59 patients got enrolled in the study. 40 patients completed 8 weeks, 19patients completed 6-week PR, 12 Patients completed 4-week PR, 31 patients not enrolled in PR Program. Overall, 18 patients diagnosed COPD, 13 Patients ILD, 9 patients' other conditions (OSA, Post-COVID, Bronchiectasis). LCADL score, MRC grade, 6MWTD, pulmonary function test, could show statistically significantly difference, pre and post PR Program as depicted in Table 2 around 40 patients could successfully finish 8 weeks of PR Program. We found that pulmonary rehabilitation had beneficial effects on the patients, both subjectively and objectively at the end of the 8 weeks. We found that pulmonary rehabilitation had beneficial effect on patients both subjectively and objectively at the end of 8th week.

Conclusion: Pulmonary rehabilitation is a scientifically endorsed modality for patients with respiratory diseases. We documented improvement in quality of life, which is lesser symptoms and improved exercise capacity.

Keywords: Pulmonary rehabilitation, Quality of life, Chronic respiratory diseases

Introduction

Chronic respiratory diseases (CRDs), including chronic obstructive pulmonary disease (COPD), asthma, interstitial lung disease (ILD), and bronchiectasis, represent a significant global health burden. These conditions are characterized by persistent respiratory symptoms and airflow limitation, which significantly impair pulmonary function and quality of life (QoL). Pulmonary rehabilitation (PR) has emerged as a cornerstone intervention in the management of CRDs, aiming to improve functional capacity, alleviate symptoms, and enhance overall QoL. This introduction will explore the influence of pulmonary rehabilitation on pulmonary function and quality of life in individuals with chronic respiratory diseases, supported by recent and relevant literature. [1-3] Chronic respiratory diseases are leading causes of morbidity and mortality worldwide. The Global Burden of Disease Study 2017 reported that CRDs were responsible for 3.9 million deaths and 103 million disability-adjusted life years (DALYs) globally. COPD alone is projected to become the third leading cause of death by 2030. These diseases impose substantial health care costs and significantly reduce patients' ability to perform daily activities, thus diminishing their QoL. Pulmonary rehabilitation is a comprehensive intervention that includes patient assessment, exercise training, education, and behavioural modification, designed to improve the physical and psychological condition of individuals with CRDs. The American Thoracic Society and the European Respiratory Society define pulmonary

rehabilitation as a multidisciplinary program 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. The primary goal of pulmonary rehabilitation is to enhance the QoL of patients with CRDs. [4,5] This is achieved through improved physical fitness, better symptom management, and increased psychological well-being. The mechanisms through which pulmonary rehabilitation enhances pulmonary function and QoL include improved muscle strength, better cardiovascular fitness, and reduced systemic inflammation. Exercise training increases the efficiency of oxygen utilization and reduces the work of breathing, thereby alleviating dyspnoea. Education and behavioural changes also play a crucial role in managing symptoms and preventing exacerbations. Moreover, the psychological support provided during PR helps in reducing anxiety and depression, which are common comorbidities in patients with CRDs. [6-8] Despite the proven benefits, the uptake and adherence to pulmonary rehabilitation programs remain suboptimal. Barriers include lack of access to PR programs, inadequate referral by healthcare providers, and patient-related factors such as transportation issues and lack of motivation. Future research should focus on developing strategies to overcome these barriers and enhance the accessibility and acceptability of PR. Additionally, there is a need for more studies evaluating the long-term benefits of PR and its impact on different populations with varying degrees of disease severity. [9-12]

Materials and Methods

This study was conducted in the Department of Pulmonary Medicine, Holy Promise Hospital , Patna, Bihar, India for one year. A total of 80 patients with diagnosed chronic respiratory disease were referred for pulmonary rehabilitation. Out of these 40 patients enrolled into the program. Patients with clinically stable mild to moderate obstructive & restrictive condition were included in the study. The diagnosis lung disease was based on the pulmonary function test with detailed history & HRCT. As a prerequisite to enrollment, all patients underwent a detailed assessment of clinical history, investigation, and comorbidity status assessment by a Pulmonologist by any other fraternity physicians were needed. A written informed consent was obtained. The study population included 14 male and 26 females. With the mean age of 56.3 13.6. The outcome measures namely quality of life (LCADLS), aerobic capacity (6MWTD), and MRC grade, functional capacity (PFT) was assessed in these patients when they enrolled into the program (0 week) and at the end of the program (8 week).

Inclusion Criteria

- Clinically stable chronic respiratory disease.
- Both Gender included.
- Age 30 to 70 years.
- Dyspnea grade at least 1(MRC) scale.
- Who have PFT done?

Exclusions Criteria

- Unstable Vitals.
- Severe exercise-induced hypoxemia, not correctable with O2 supplementation.
- Angina pectoris, recent myocardial infarction, severe pulmonary hypertension.
- Recent surgical or any other musculoskeletal injury.
- Psychiatric illness, dementia.

Physical reconditioning, respiratory muscle training and upper and lower extremities strengthening exercises. Breathing training comprised of breathing technique (pursued lipped, Diaphragmatic breathing, intercostal and segmental), pacing and energy conservations. Lower limb: lower limb muscle dysfunction is largely responsible for exercise limitation in respiratory disease patients. [11] Exercise training has muscle group specific effects and lower extremity training provides the best physiological gains, according to the present evidence- based guidelines. [1,2,12] Lower exercise training usually done by level walking, treadmill walking, cycling, modified weightlifting may be considered. Upper limb: upper extremity training is useful as it has been shown to decrease oxygen demand and increase arm muscle capacity at similar work level following pulmonary rehabilitation, arm weightlifting. Combined upper & lower limb training results in significant improvement in exercise performance and health related quality of life. Type of exercises. Patients were subjected to a structured program which was individually tailored to each patient according to their level of functional impairment, severity of disease like (Grade of dyspnea, hypoxemia), presence of co morbid disease and any other potential factors that could limit intensity or safety of exercise. patient's mandatory exercised for 45 to 60 minutes, 2 to 3 times a week for 8 weeks. The program focusing on endurance training, strength training, and flexibility is the cornerstone of pulmonary rehabilitation. The goal is to improve patients' aerobic capacity and muscle strength. 13The exercise load and repetitions are increased over a time in supervised fashion to help build up strength, muscle mass, endurance. The best strategy is to include endurance training or interval training along with resistance The training in individual exercise plan as it is known to confer best benefit than individuals components by themselves. [14] Reassessment on the end of the 8th week, hemodynamic measurement (BP, PR SPO2), Dyspnea grade by MRC scale, quality of life LCADL score (London chest activity daily living

sale), 6-minute walk distance, pulmonary function. Table 1

Statistical Analysis

Data was entered into Microsoft Excel and analyzed using Stata Version 13. For linear variables, mean, medians, standard deviation, and Inter Quartile Ranges (IQR) were calculated and for categorical variables, proportions were used. Paired t-test was used to compare mean between two groups (pre-and post-means respectively). Distribution of continuous variables across multiple groups were assessed using the Kruskal Wallis test. p Value of less than 0 05 was statistically significant.

Results

A total 80 patients were referred for pulmonary rehabilitation at pulmonary rehabilitation department, 59 patients got enrolled in the study. 40 patients completed 8 weeks, 19patients completed 6-week PR, 12 Patients completed 4-week PR, 31 patients not enrolled in PR Program. Overall 18 patients diagnosed COPD, 13 Patients ILD, 9 patients' other conditions (OSA, Post-COVID, Bronchiectasis). LCADL score, MRC grade, 6MWTD, pulmonary function test, could show statistically significantly difference, pre and post PR Program as depicted in Table 2 around 40 patients could successfully finish 8 weeks of PR Program. We found that pulmonary rehabilitation had beneficial effects on the patients, both subjectively and objectively at the end of the 8 weeks as depicted in Table 2. We found that pulmonary rehabilitation had beneficial effect on patients both subjectively and objectively at the end of 8th week as depicted in Table 3. Effects of PR Program pre & post on patients' parameters. Distance walked on the 6 MWT increased by 20%; dyspnea score decreased by 6.4%; quality of life (LCADLS) score reduced disability; FEV1 & FVC had improved 5.6%. Improvement, in 6MWT, LCADLS, MRC grade, were greater than the MCID (Minimal clinically import).

Table 1: Exercise training session

Warm up & cool down	Endurance training	Strength training	Flexibility exs
ROM exs Breathing es 5 to10 min	Level Walking (60-80%)/Treadmill walking, Cycling. 10 to 15 min	Upper limb free weight, lower limb ankle weight. (50 to 85%of the 10 RM), Pelvic floor muscle training. 15 to 20 min	Stretching exs (TheraBand, Thera tube,) Postural corrections exs, Core muscle training exs, Balance training exercise.

Table 2: Baseline characteristics of all parameters.

Baseline characteristics Variables	Baseline characteristics Variables	Baseline characteristics Variables	Baseline characteristics Variables	Baseline characteristics Variables
MRC Grade	1.9±0.591	0.45±0.50	1.33-0.479	0.87-0.34
LCADL score	46.85±6.923	30.68±7.25	43.±12.32	44.23±6.04
1-Self care	8.71±12.32	7.60±11.20	7.74±11.5	8.50±12.5
2-Domestic	13.5 ±9.3	8.8±2.05	12.49±8.5	11.5±7.5
3-physical	6.54±-0.45	5.5±0.30	7.56±1.40	6.7±1.60
4-Leisure	6.40±2.20	5.30±2.10	6.49±3.0	7.50±4.5
6MWTD	169.5±68.5021.	324.5±71.515	155.33±33.08	185.67±45.0
FVC	56.20±3.24	58.20±2.70	48.50±6.9	47.82±6.6
FEV1	52.30±3.23	56.73±3.05	51.32±2.98	50.88±2.30

Table 3: Effects of PR Program pre & post on patients' parameters.

variable	Pre-PRn=40 Mean±SD	Post-PRn=40 Mean±SD	P value
LCADLS	46.85±6.923	30.68±7.259	<0.001
MRC	1.9±0.591	0.45±0.50	<0.001
6MWTD	169.5±68.502	324.5±71.515	<0.001
FEV1	52.30±3.23	56.73±3.05	<0.05
FVC	56.20±3.24	58.20±2.70	<0.05

LCADL-London chest activity daily living m MRC-modified medical research council.

Table 4: Response to PR.

Variable	ILD n=15 Mean ±SD	COPD n=19 Mean ±SD	P Value
M MRC	2.9±1.3	3.2±1.0	<.001
LCADLS	14.9±5.8	13.5±3.4	<.001
6MWTD	250±3.2	330±10.2	<.001
FEV1	58.3±3.5	53.5±4.5	<.004
FVC	49.5±2.6	56.3±6.8	<0.05

Table 5: Effects on control group parameters after 8 weeks

Parameters Control group	Pre-PR Mean ±SD. n=40	Post-PR Mean ±SD. N=30	P value
6MWTD	155.33+33.086	185.67±45.0	<0.001
LCADL	43.73±7.965	44.23±6.463	<0.001
MRC	1.33±0.479	1..87±0.734	>0.0002
FVC	48.50±6.9	47.82±6.6	>0.482
FEV1	51.32±2.98	50.88±2.30	>0.45

Discussion

We showed that the 8-week PR program has improved exercise capacity, quality of life and lung function of a chronic respiratory disease, PR Program in a specialized center on patients with chronic respiratory disease patients. Our data demonstrate that PR is beneficial in these patients and appears to be a valuable adjunct therapy. Our results show statistically significant all the parameters. (LCADL, 6MWTD, FEV1). Among non- pharmacological interventions treat these clinical entities, regular exercise is known to be a low-cost solution to improve health, well-being, and economic productivity of patient's chronic lung disease, especially for those with ILD, in whom conventional pharmacological treatment has shown a limited response. LCADL score was pre 46 points to after 8-week PR 30 points for the PR group and for the control groups, 43 to 44 score respectively. Therefore, the control group presented higher LCADL scores than the PR group.it mean that. Control group patients lead to higher dyspnea perception which leads to a lower ability to perform activities of daily living. LCADL score >28% had worse pulmonary function, dyspnea & health related quality of life 15 patients required oxygen support (where spo2<90% at baseline). Use of oxygen during rehabilitation has been shown to help an individual to undergo moderate intensity exercise training. Oxygen is supplied continuously or on demand basis, according to the need of individual patients. This study has shown support for the hypothesis that dyspnea during routine activities leads to significant disability in chronic respiratory disease. Total score LCADL Score was in the present study 69% of the patients in the sample achieved a total LCADL score. The improvement in dyspnea, evaluation was matched with Tonelli et al., [15] Baradzina et al. who demonstrated a decline in m MRC score was statistically significant difference after the PR Program. Health related quality of life can be defined as "the gap between our expectations of health and our experience of it". [14] A primary aim of the treatment of chronic disease is to enhance quality of life by reducing the impact of the disease. However, the relationship between symptoms and exercise capacity, or functional limitation and quality of life, is neither simple nor direct. Therefore, we explored the association between dyspnea & quality of life.

A Dyspnea grade clinical improvement in dyspnea was observed > 50% of the patients, in line with existing evidence on the benefits of PR in patients' chronic respiratory disease patients.[12] This result demonstrates that patients with chronic respiratory disease already experience restrictions in their daily life due to dyspnea and that PR has the potential to reverse this situation. Regarding the effect on day-to-day activities, a change in LCADLS score pre & post mean difference was -2 to -5.9 points. This change is MID, MID range for LCADL total range -3.88 obtained by Bisca et al.,2014. Quality of life was also associated with decreased dyspnea in all the patients ,which is consistent with a previous study that identified HRQoL to be adversely and independently associated with respiratory symptoms (dyspnea, wheeze, and cough, fatigue, leg pain), age and female gender.[15] where the advancements in medicine still facing challenges offering enthusiastic options in pharmacological therapies to this subset of patients, at least PR helps by alleviating the symptoms which is of a paramount importance by preventing them from falling in the vicious cycle of deconditioning and poor exercise tolerance. [15] Benefits in QOL and symptoms cannot be ignored, indicate to continue PR as regular part in patients care. The post PR found significant improvement in 6MWTD of 324m (76.6) m which was 20.8% of the baseline value. The mean difference in distance covered pre and post PR was the change was 155m, which was clearly more than minimal clinically important distance. When ILD Patients were analyzed 56 m gain was noted in 6 MWTD was found. In COPD patients 64 m is accepted as significant. Across the world when literature on ILD and COPD patients was analyzed, our findings

matched almost all the available work in this area. Holland et al. [16] may conclude that between 29 to 34 m in ILD Patients is significant improvement functional capacity in this population. In ILD Patients Ryerson and colleagues showed how a lower baseline 6MWD could predict larger improvement in distance covered after PR. PR has been proven that significant difference in FEV1 & FVC after PR. Pre PR FEV1 52.30 & Post PR 56.73 mean difference was 5.3. This result had a better baseline score compared with the patient's previous study. Cristina et al., Pre PR FVC 56.20 & post PR was 58.20, the mean difference was pre & post 2.40. The MID range 0.08 to 0.1.L. [17] We noted an improvement in FEV1& FVC after PR, which indicates that PR can be beneficial to lung function in patients with chronic respiratory disease. FEV1 & FVC The current study investigated the possible effect of PR on some spirometry parameters FEV1. There was statistically significant improvement between the PR group pre & post, there was greater improvement in the PR groups than the control group at 8 weeks. There is a good rationale for the use of PR in chronic respiratory disease. Exercise training aerobic capacity, muscle strength and flexibility, contributing to less dyspnea on exertion and improvement of functional status. Supervised PR maintenance program is effective in the early stages to better tailor exercise training to the patient and thereby increase program compliance, 2–4 and can replaced by non- supervised sessions, maintaining a good impact on functional capacity, and decreasing health system burdens.

Conclusion

Pulmonary rehabilitation is a scientifically endorsed modality for patients with respiratory diseases. We documented improvement in quality of life, which is lesser symptoms and improved exercise capacity. It's no longer all about comfort zone that patient gets, it has rather emerged as a measure that imparts statistically significant enhancements patients care in term of both subjective and objective parameters.

References

1. Bassetti M, Bouza E, Cocciolillo G, Muñoz P, Paiva JA, Timsit JF, et al. Epidemiology, diagnosis and treatment of invasive fungal infections in immunocompromised patients. J Antimicrob Chemother. 2020;75(2):343-354. doi:10.1093/jac/dkz437.
2. Bongomin F, Gago S, Oladele RO, Denning DW. Global and multi-national prevalence of fungal diseases—estimate precision. J Fungi (Basel). 2017;3(4):57. doi:10.3390/jof304005 7.
3. Hoenigl M, Seidel D, Carvalho A, Rudramurthy SM, Arastehfar A, Gangneux JP, et al. The Emergence of COVID-19 Associated Mucormycosis: A Review of Cases from 18 Countries. Lancet Microbe. 2022;3(9). doi:10.1016/S2666-5247(21)00237-8.
4. Lockhart SR, Guarner J, Hite JL, Pfaller MA, Barousse M, and Brandt ME. Diagnostic Mycology in the 21st Century. Clin Microbiol Rev. 2020;33(2). doi:10.1128/CMR.00055-19.
5. Nucci M, Anaissie E. Fusarium infections in immunocompromised patients. Clin Microbiol Rev. 2007;20(4):695-704. doi:10.1128/CMR. 00014-07.
6. Pappas PG, Kauffman CA, Andes DR, Clancy CJ, Marr KA, Ostrosky-Zeichner L, et al. Clinical practice guidelines for the management of candidiasis: 2016 update by the Infectious Diseases Society of America. Clin Infect Dis. 2016;62(4). doi:10.1093/cid/ civ933.
7. Perfect JR, Dismukes WE, Dromer F, Goldman DL, Graybill JR, Hamill RJ, et al. Guidelines for the diagnosis and management of cryptococcal disease: 2010 update by the Infectious Diseases Society of America. Clin Infect Dis. 2010;50(3):291-322. doi:10.1086/ 649858.
8. Richardson M, Lass-Flörl C. Changing epidemiology of systemic fungal infections. Clin Microbiol Infect. 2008;14(5):5-24. doi: 10.1111/j.1469-0691.2008.01978.x.
9. Verweij PE, Te Dorsthorst DT, Rijs AJ, De Vries-Hospers HG, Meis JF. High-dose liposomal amphotericin B for treatment of fungal infections in immunocompromised patients: a review of the literature. J Antimicrob Chemother. 2008;61(2):309-320. doi:10.1093/jac/dkm497.
10. Spruit MA, Singh SJ, Garvey C, ZuWallack RL, Nici L, Rochester C, et al. An official American Thoracic Society/European Respiratory Society statement: key concepts and advances in pulmonary rehabilitation. Am J Respir Crit Care Med. 2013;188(8). doi: 10.1164/rccm.201309-1634ST.
11. Rochester CL, Vogiatzis I, Holland AE, Lareau SC, Marciniuk DD, Puhan MA. An Official American Thoracic Society/European Respiratory Society Policy Statement: Enhancing Implementation, Use, and Delivery of Pulmonary Rehabilitation. Am J Respir Crit Care Med. 2015;192(11):1373–86.
12. Martijn AS, Ingrid MLA, Lowie EV, Daisy JAJ, Swetlana G, Herman- Jan P, et al. Rehabilitation Network. Differential response to pulmonary rehabilitation in COPD: multidimensional profiling. Eur Respir J. 2015; 46(6):1625–35.
13. Blervaque L, Préfaut C, Forthin H, Maffre F, Bourrelier M, Héraud N, et al. Efficacy of a long-term pulmonary rehabilitation maintenance program for COPD patients in a real-life setting: a 5-year cohort study. Respir

Res. 2021;22(1):79. doi:10.1186/s12931-021-01674-3.
14. Andrew LR, Gerene SB, Brian WC, Richard C, Charles FE, Donald AM, et al. Pulmonary Rehabilitation: Joint ACCP/AACVPR Evidence-Based Clinical Practice Guidelines. Chest. 2007;131(5 Suppl):4–42.
15. Arnold MT, Brett AD, Christopher BC. Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease: Highly Effective but Often Overlooked. Tuberc Respir Dis (Seoul). 2020;83(4):257–67.
16. Henoy MA, Paul V. Pulmonary Rehabilitation. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023.
17. Yang F, Gao L, Wang Q, Weiping D, Wei G. Effect of exercise-based pulmonary rehabilita tion in patients with bronchiectasis: A meta-analysis. Respir Med Res. 2022;p. 100910. doi:10.1016/j.resmer.2022.100910.