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Impact of pulmonary rehabilitation training on Chronic Obstructive Pulmonary Disease (COPD) and asthma patients

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Abstract

The objective of this study is to assess the impact of pulmonary rehabilitation training in the management of asthma and chronic obstructive pulmonary disease patients. A 6-month prospective interventional study was conducted in a tertiary care hospital that included participants above 18 to less than 70 years of age admitted to the general medicine ward with the diagnosis of mild-moderate chronic obstructive pulmonary disease and asthma without any other comorbidity or concurrent illness. The rehabilitation procedure consisted of breathing exercises and endurance training. Parameters like FEV1, FVC, modified medical research council scale, modified BORG grade, 6-minute walk test, and questionnaire like SF-36 were measured and compared with post-training results. A total of 80 patients were enrolled in the study. The pre and post-rehabilitation comparison in both COPD and asthma patients showed significant results in terms of improved dyspnea (FEV1, FVC, FEV1/FVC ratio; p=0.001) evident with modified Medical Research Council scores and modified BORG grades followed by significant differences in distance covered during 6-minute walk test (p=0.001) and health-related quality of life (SF-36 scores; p=0.001). Conclusion: Pulmonary rehabilitation significantly improved exercise tolerance, perception of dyspnea, health-related quality of life, and psychosocial behavior. Inclusion of pulmonary rehabilitation in COPD and asthma patients is essential to palliate the disease burden, reduce the rate of hospitalizations and improves the quality of life of a patients.

Keywords: Pulmonary rehabilitation; COPD; Asthma; Exercise tolerance; Quality of life

1. Introduction

Pulmonary rehabilitation (PR) is considered a vital component in the management of chronic respiratory diseases. As per the official statement published by the American Thoracic Society (ATS) and European Respiratory Society (ERS), pulmonary rehabilitation is a "comprehensive intervention based on a thorough patient assessment followed by patient-tailored therapies that include, but are not limited to, exercise training, education, and behavior change, designed to improve the physical and psychological condition of people with the chronic respiratory disease and to promote the long-term adherence to health-enhancing behaviors" [1]. The publication discusses key concepts and advances in pulmonary rehabilitation that served as the background for the current study. It describes the significant role of pulmonary rehabilitation in improving exercise capacity, knowledge, 'self-efficacy' 'emotional function', and quality of life in patients with chronic obstructive pulmonary disease (COPD) and is considered to be a safe and effective method in acute COPD exacerbations and reduces following hospital admissions [1]. The evidence suggests that there is physical inactivity in COPD patients [2] [3], leading to the reduction in quality of life (QOL), increase in the rate of

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hospitalizations, and mortality [2]. Pulmonary rehabilitation positively impacts the quality of life by enhancing exercise capacity and psychosocial aspects of routine life. It is also influential in the reduction of anxiety and depression in COPD patients [4]. The primary goal of the PR is to break the cycle of breathlessness and de-conditioning in COPD through training, thereby improving the functional capacity of lungs and quality of life. The PR includes many types of training: endurance training, interval training, resistance and strength training, and neuromuscular electrical stimulation. Endurance training is beneficial in exercise tolerance and functional capacity consisting of exercises like walking, cycling, squats, stair climbing followed by breathing techniques, stretching exercises and resting periods, resistance, and strength training by lifting weights. Recently published studies suggest that the utilization of neuromuscular electrical stimulation in pulmonary rehabilitation is effective in increasing exercise capacity [5]. The presence of physical inactivity in asthma patients due to fear of dyspnea and triggering of symptoms can also be rectified with pulmonary rehabilitation training. The training positively impacts physical function and emotional well-being [6]. It has been reported that exercise training improves asthma symptoms and health-related quality of life [7] [8]. The objective of this study is to assess the impact of short-term pulmonary rehabilitation training in the management of COPD and asthma patients as a supportive measure.

2. Material and methods

2.1. Study Design

A prospective interventional study was conducted in a tertiary care hospital among inpatients with a diagnosis of asthma and COPD without any other concurrent diseases or disorders, aging from 18 years to 70 years, over a period of 6 months. A total of 80 patients with moderate manifestations (non-ventilated) of asthma and COPD were enrolled for the rehabilitation training after obtaining informed consent. Data were collected regarding the patient's demography, past medical and medication histories, diagnosis, complete prescription, using a predesigned pro forma. Before to start the current work it was taken a permission from Institutional Ethics Clearance (BLDE (DU)/IEC/317/2017-18) from Shri B M. Patil Medical College Hospital and Research Centre Vijayapur.

2.2. Sample Size and Statistical Analysis

The minimum sample size was 40 per group (Total Sample size=80) with a 99% level of significance and 80% power. Numerical variables are presented as Mean ±SD. Paired t-test was used for comparison of results within the groups of asthma and COPD with a p-value <0.05.

2.3. Measurement of Pulmonary Functions and Dyspnea

Pulmonary function tests like FEV_1 (Forced Expiratory Volume in 1 minute), FVC (Forced Vital Capacity), and FEV1/FVC ratio along with scales like modified Medical Research Council (mMRC), modified BORG dyspnea (mBORG) scale were measured at baseline and repeated after training.

2.4. Assessment of Health-related Quality of Life

The health-related quality of life (HRQOL) of all the participants was measured using the 36-Item Short Form Survey (SF-36) questionnaire before and after training. The questionnaire consisted of 8 domains namely: General Health, Limitations of Activities, Physical Health Problems, Emotional Health Problems, Social Activities, Pain, Energy, and Emotions.

2.5. Measurement of Endurance

6MWT (6-Minute Walk Test) was performed according to the ATS guidelines. Equipment like a pulse oximeter, countdown timer, sphygmomanometer, training cones were used for the test. The distance covered by all the patients was recorded before and after training.

2.6. Pulmonary Rehabilitation Training:

A bedside pulmonary rehabilitation procedure consists of breathing exercises and endurance training such as walking was conducted for a period of 1 month. Breathing exercises such as diaphragmatic breathing [9], pursed-lip breathing [10], huff-cough technique [11], pranayama [12] were included along with endurance training through walking. The training plan was customized according to individual patients' convenience.

3. Results and discussion

Out of the 80 patients enrolled in the present study, 66% (n=53) patients were aged between the age group of 50-69 years followed by 34% (n=27) between 30-49 years (Table 1). Among them, male patients were predominant (67.5%, n=54) followed by females (32.5%, n=26) (Table 2). In terms of age group association with gender, most of the males and females were between 50-69 years of age (Table 3), which was similar to the disease-wise age distribution of participants (Table 4). The pre and post-rehabilitation comparison of the mean for FEV_1, FVC, and FEV1/FVC ratio is tabulated in (Table 5), accordingly, mMRC scores, mBORG grades, distance covered in the 6MWT test along with SF-36 scores are given in (Table 6). The results show statistically significant improvement ($p<0.001$) in both COPD and asthma patients.

Table 1 Age distribution of both the groups (Asthma and COPD)

Age groups (years)	Number of subjects	Percentage (%)
30-49	27	34%
50-69	53	66%
TOTAL	80	100%

Table 2 Gender distribution of both the groups (Asthma and COPD)

Gender	Number of patients	Percentage
Male	54	67.5%
Female	26	32.5%
Total	80	100%

Table 3 Association of age with gender

Age groups (Years)	Male	Female
30-49	33% (n=18)	53% (n=9)
50-69	67% (n=36)	65% (n=17)
Total	54	26

Table 4 Distribution of age groups according to diseases

Age groups (years)	COPD	Asthma
30-49	38% (n=15)	30% (n=12)
50-69	63% (n=25)	60% (n=28)
Total	40	40

Claire Egan et al reported similar post-PR results in COPD patients in terms of improved quality of life and reduces breathlessness [3]. Similarly in the present study, a comparison between pre and post-training in both the groups depicted a significant change in the HRQOL and exercise capacity. Along with COPD patients, a similar impact was seen in asthma patients too. The SF-36 questionnaire consisted of 8 domains namely general health, limitation of activities, physical health problems, emotional health problems, pain, energy and emotions, social activities, and health change.

The results presented significant differences in all the domains for both asthma and COPD patients. Specifically, the training improved psychosocial behavior and reduced physical limitations in day-to-day activities i.e. enhanced exercise capacity and tolerance, except for general health where the attitude of the participants towards the disease almost remained the same. These findings are supported by a study published in the Turkish Thoracic Journal by Sami Deniz et al [13], which discussed the positive impacts of pulmonary rehabilitation on health-related quality of life. Despite the significant differences in mean FEV_1, FVC values, and FEV_1/FVC ratio, the training was not successful in alleviating the symptoms completely, rather improved their attitude and perspective towards dyspnea. It was evident with the reported mean scores of mMRC and grading of mBORG. Accordingly, in the 6-minute walk test, there were significant differences in distance covered by both asthma and COPD patients. The present study describes the beneficial role of pulmonary rehabilitation in both asthma and COPD patients. It resulted in improvement of dyspnea, exercise capacity, and HRQOL with statistical significance.

Table 5 Comparison of Pre and Post Pulmonary Rehabilitation FEV_1, FVC and FEV_1/FVC ratios for COPD and Asthma Patients

Parameters	COPD (MEAN±SD)		p value	Asthma (Mean±SD)		p value
	PRE	POST		PRE	POST	
FEV_1	1.93±032	2.79±0.37	0.001	1.90±0.28	2.49±0.40	0.001
FVC	3.095±0.44	3.76±0.43	0.001	2.91±0.36	3.40±0.53	0.001
FEV_1/FVC RATIO	61.93±7.29	71.88±4.64	0.001	64.57±3.95	73.77±3.43	0.001

Measuring Parameters: FEV_1- Forced Expiratory Volume (in one minute), FVC- Forced Vital Capacity.

Table 6 Comparison of Pre and Post Pulmonary Rehabilitation SF-36, 6MWT, mMRC, mBORG measurements for COPD and Asthma Patients

Parameters	COPD (Mean±SD)		p value	Asthma (Mean±SD)		p value
	PRE	POST		PRE	POST	
SF -36						
General Health	43.5±4.86	56±8.98	0.001	43.33±8.20	60.67±6.29	0.001
Limitation of Activities	61.17±17.35	81.37±11.42	0.001	68.83±13.70	86.5±6.97	0.001
Physical Health Problems	25.83±24.57	81.67±23.21	0.001	31.67±25.77	83.33±16.24	0.001
Emotional Health Problems	48.82±30.83	66.17±19.50	0.001	45.53±26.67	69.87±18.12	0.001
Pain	51.28±11.87	71.73±11.91	0.001	44.90±11.51	66.93±10.97	0.001
Energy and Emotions	55.52±6.45	66.73±5.020	0.001	52.88±5.87	71.87±6.97	0.001
Social Activities	55.25±14.93	85.2±12.05	0.001	59.37±12.87	90±10.17	0.001
Health Change	52.5±18.65	77.5±17.5	0.001	51.67±23.21	73.1±11.09	0.001
mBORG	3±1.033	2±0.81	0.001	2.77±0.81	1.6±0.75	0.001
mMRC	1.23±0.99	0.73±0.727	0.001	1.6±0.172	0.8±0.653	0.001
6MWT	378.97±68.25	481.33±65.28	0.001	466.6±98.73	551.63±98.47	0.001

Measuring parameters: SF-36- 36-Item Short Form Survey, mBORG-Modified BORG scale, mMRC- modified Medical Research Council, 6MWT- 6-minute walk test

4. Conclusion

The present study describes the beneficial impact of pulmonary rehabilitation training in both COPD and asthma patients. It significantly improves exercise tolerance, perception of dyspnea, health-related quality of life, and psychosocial behavior. Hence, the inclusion of pulmonary rehabilitation training along with the intended

pharmacotherapy in COPD and asthma patients is an essential component to alleviate disease burden and reduce the rate of hospitalization.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors do not have any conflict of interest to declare.

Statement of informed consent

A Verbal informed consent was obtained from the patients who are willing to take part in the present study.

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