

Research Article

A Comparative Evaluation of Pulmonary Rehabilitation and Standard Medical Therapy in Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Background: Pulmonary rehabilitation is an evidence-based intervention to improve the quality of life (QOL) of patients with chronic obstructive pulmonary disease (COPD). The objective of the study was to determine the effect of pulmonary rehabilitation on quality of life among patients with COPD and to identify the association of quality of life with selected demographic variables of COPD patients.

Materials and Methods: An evaluative approach with a quasi-experimental design using a control group was adopted for the study. Thirty patients with moderate COPD were enrolled. Patients were randomized into two groups: the study group received a pulmonary rehabilitation programme plus standard medical therapy (SMT) (n = 15), while the control group received standard medical treatment. **Results:** Pulmonary function was assessed before the breathing exercises. The overall mean FEV₁ was approximately 0.11 ± 0.42 in the study group and 0.03 ± 0.22 in the control group. Patients in the study group showed significant improvement ($p = 0.000$) in the SGRQ activity score. Improvement (12.04 ± 6.99) in the SGRQ impact score was observed in the study group, while

improvement (0.24 ± 0.88) in the SGRQ impact score was also present in the control group. No significant association was found between the control and study groups with respect to demographic characteristics ($p > 0.05$). The chi-square test showed a significant association between demographic characteristics, namely, history of exposure to smoke, duration of exposure to pollutants, duration of illness, and study/control group ($p < 0.05$). The remaining characteristics were not significant ($p > 0.05$). **Conclusions:** The pulmonary rehabilitation programme improved exercise capacity, symptoms, and health-related quality of life without any significant change in pulmonary function.

Keywords: Pulmonary rehabilitation, Quality of Life (QOL), Chronic Obstructive Pulmonary Disease (COPD).

INTRODUCTION

Chronic obstructive pulmonary disease is a major health problem in India. In 2012, it was ranked as the third leading cause of death, killing over 3 million people.

Chronic obstructive pulmonary disease is characterized by airflow limitation, leading to reduced ventilatory capacity and associated shortness of breath. Globally, it

was estimated that about 3 million deaths were caused by the disease in 2015 (that is, 5% of all deaths globally in that year). More than 90% of COPD deaths occur in low- and middle-income countries.

Pulmonary rehabilitation is a multidisciplinary programme of care designed to optimize quality of life. It improves exercise capacity in patients with COPD, reduces dyspnoea, improves quality of life, and minimizes hospital stay.

A randomized controlled study was conducted in Los Angeles to assess the efficacy of pursed-lip breathing as a breathing-pattern retraining strategy for dyspnoea reduction. The study results revealed a significant reduction in the Modified Borg Scale score after six-minute walking distance (6MWD) assessment ($p = 0.05$) and improvement in physical function ($p = 0.02$) from baseline to 12 weeks. These findings were reported only for pursed-lip breathing.

Previous studies suggest that pursed-lip breathing provides sustained improvement in exertional dyspnoea and physical function.

Cristoforo Incorvaia et al. (2014) conducted a prospective study comparing a group of 190 COPD patients undergoing pulmonary rehabilitation (PR) with a group of 67 patients treated only with drugs. A mean improvement in FEV₁ from 1240 mL to 1252.4 mL was observed in the former group, whereas the values changed from 1367 mL to 1150 mL in the latter group ($p < 0.001$). These observations suggest that lung function may improve in COPD patients undergoing pulmonary rehabilitation.

A quasi-experimental study was conducted in Iran to assess the effects of pursed-lip breathing on respiratory function, arterial blood gases, ventilation, and activities of daily living in patients with COPD. The results revealed a significant increase in oxygen saturation ($p < 0.05$) and improvement in activities of daily living ($p < 0.001$). This suggests that breathing retraining can improve respiratory function,

arterial blood gas parameters, and the ability to perform daily activities. Therefore, breathing retraining should be included in respiratory physiotherapy programmes for patients with COPD.

A correlation study on health-related quality of life (HRQOL) and disease severity indices in Indian patients with chronic obstructive pulmonary disease showed significantly reduced HRQOL when measured using the St George's Respiratory Questionnaire (SGRQ). The study concluded that patients with COPD had reduced HRQOL. Longer disease duration, patients' perception of disease severity, and worsening dyspnoea negatively affected HRQOL.

A study conducted in Japan evaluated the effects of a short-term pulmonary rehabilitation programme in patients with chronic respiratory failure due to pulmonary emphysema. The findings suggested that the programme relieved dyspnoea, increased functional exercise capacity, and decreased total lung capacity and residual volume in patients with chronic respiratory disease.

Another study found that the total number of hospital admissions decreased after one year. In the control group, admissions decreased from 24.7% to 11.5% ($p = 0.002$), while in the experimental group they decreased from 30.8% to 9.9% ($p = 0.001$). The study concluded that patient education for COPD improves the effectiveness of inpatient rehabilitation programmes, improves quality of life, reduces morbidity, and supports lifestyle changes. Therefore, education should be an essential component of pulmonary rehabilitation in COPD.

OBJECTIVES

1. To determine the effect of pulmonary rehabilitation on the quality of life of patients with chronic obstructive pulmonary disease (COPD).
2. To identify the association between quality of life and selected

demographic variables among patients with COPD.

MATERIALS AND METHODS

Research Design: The present study used a quasi-experimental design with a pre-test and post-test control group approach.

Setting: The study was conducted at Pravara Rural Hospital, Loni (BK), Maharashtra.

Population: The population included patients with chronic obstructive pulmonary disease admitted to tertiary health care centre

Sample Size: Thirty patients.

Sampling Technique: Simple random sampling with random assignment to each group.

Inclusion Criteria:

1. Patients diagnosed with chronic obstructive pulmonary disease.
2. Patients aged above 35 years.
3. Patients admitted to the medical ward of Pravara Rural Hospital.
4. Patients willing to undergo the rehabilitation programme.
5. Patients able to understand and read Marathi.

Exclusion Criteria:

1. Patients with comorbid illnesses such as cancer, heart failure, ischaemic heart disease, psychiatric illness, or neurological disease.
2. Patients unable to follow the rehabilitation programme.

Study Tool: A self-administered questionnaire was used.

Section A: Sociodemographic profile of COPD patients and clinical characteristics.

Section B: Clinical measurements, including:

- Clinical assessment
- Pulmonary function test
- Six-minute walking distance test
- Modified Borg's Scale for dyspnoea

MATERIALS AND METHODS (Continued)

The pulmonary rehabilitation programme was administered according to recommendations based on standard

evidence-based guidelines. The duration of the rehabilitation programme was 12 weeks. It included deep breathing exercises, pursed-lip breathing, diaphragmatic breathing, controlled coughing, incentive spirometry, and pranayama, including Om Chant, Surya Bedhana, Anulom Vilom, Ujjayi, and Bhramari.

Each exercise session lasted up to two hours, with adequate rest intervals as required. In addition, patients received education about the disease, smoking cessation, and lifestyle modification to relieve dyspnoea. Follow-up visits were conducted by the researcher after discharge for up to three months.

St George's Respiratory Questionnaire

The St George's Respiratory Questionnaire (SGRQ) is a standardized, self-administered questionnaire used to measure impaired health and perceived health-related quality of life (HRQOL) in patients with airway disease. It contains 50 items divided into three domains: symptoms, activity, and impacts. A score is calculated for each domain, and a total score incorporating all items is also calculated. Each item has an empirically derived weight. Lower scores indicate better HRQOL.

Data Collection Procedure

Formal permission was obtained from the concerned authorities, including the Medical Superintendent and the Head of the Department of Medicine and Chest Physician. The study proposal was reviewed and approved by the Research Ethics Committee.

Subjects were selected according to the selection criteria, and confidentiality was assured. Written informed consent was obtained after explaining the benefits in detail and assuring participants of the anonymity and confidentiality of their information.

Pre-tests were conducted during the first week of hospitalization for both the study and control groups. Subjects in the study group were trained in the pulmonary rehabilitation programme. Post-tests were

conducted in both groups after three months of implementing the rehabilitation programme.

FINDINGS

Section A: Description of the Samples

The majority of subjects were in the 55–64-year age group: 9 (60%) in the study group and 10 (66.7%) in the control group. Most subjects were male: 12 (80%) in the study group and 8 (53.3%) in the control group. The majority of subjects were Hindu: 14 (93.3%) in the study group and 13 (86.6%)

in the control group. Regarding education, 10 (66.7%) of the subjects in the study group and 11 (73.3%) in the control group were illiterate.

Most subjects were farmers: 6 (40%) in the study group and 8 (53.3%) in the control group. Regarding monthly income, most subjects earned below ₹3,000 per month: 8 (53.3%) in the study group and 9 (60%) in the control group.

Table 1: Distribution of Patients According to the Clinical Profile of COPD

Clinical characteristic	Control group, n (%)	Study group, n (%)
1. History of exposure to smoke		
Active smoking	2 (13.3%)	0
Passive smoking	1 (6.7%)	14 (93.3%)
Biomass exposure	5 (33.3%)	3 (20%)
No history of smoking	3 (20%)	1 (6.7%)
If active smoker: smoking quantity		
Below 1 packet/day	2 (13.3%)	5 (33.3%)
Above 1 packet/day	0	6 (40%)
2. History of allergy		
Yes	12 (80%)	3 (20%)
No	0	0
Allergens, if present		
Pollens	5 (33.3%)	8 (53.4%)
Dust	4 (26.7%)	0
Pesticide spray	4 (26.7%)	3 (20%)

Note: This is a cleaned transcription of the visible page. Some values in the photograph are blurred or appear inconsistent with the stated sample size of 15 per group. Please verify the demographic figures and table entries against the original PDF before using them in a manuscript.

TABLE 1: DISTRIBUTION OF PATIENTS ACCORDING TO CLINICAL PROFILE OF COPD (CONTINUED)

3. Duration of Exposure to Pollutants

Duration	Control group, n (%)	Study group, n (%)
Below 1 year	0	0
1–3 years	2 (13.3%)	1 (6.7%)
3–5 years	3 (20%)	1 (6.7%)
Above 5 years	7 (46.7%)	7 (46.7%)

4. Duration of Illness

Duration	Control group, n (%)	Study group, n (%)
Below 1 year	5 (33.3%)	4 (26.7%)
1–3 years	2 (13.3%)	3 (20%)
3–5 years	2 (13.3%)	2 (13.3%)
Above 5 years	3 (20%)	6 (40%)

5. History of Comorbid Illness

Characteristic	Control group, n (%)	Study group, n (%)
Yes	0	0
No	14 (93.3%)	14 (93.3%)
Cancer	0	0
Heart failure	0	0
Ischaemic heart disease	0	0
Psychiatric illness	0	0
Neuromuscular diseases	0	0
Others	0	0

6. Regular Treatment for COPD

Characteristic	Control group, n (%)	Study group, n (%)
Yes	5 (33.3%)	7 (46.7%)
No	10 (66.7%)	3 (20%)

Treatment Modalities

Treatment	Control group, n (%)	Study group, n (%)
Allopathy	7 (46.7%)	0
Homeopathy	5 (33.3%)	0
Ayurveda	0	0
Unani	0	0
Siddha	0	0
Others	0	0

7. History of Hospitalization for COPD

Characteristic	Control group, n (%)	Study group, n (%)
Yes	3 (20%)	3 (20%)
No	0	0
Number of hospitalizations specified	6 (40%)	6 (40%)

Description of Clinical Findings

The majority of subjects, 14 (93.3%), in the study group were exposed to passive smoking, while 5 (33.3%) subjects in the control group were exposed to biomass fuel. The highest proportion of subjects in the study group, 6 (40%), smoked more than one packet per day, while 2 (13.3%) subjects in the control group smoked less than one packet per day.

A history of allergy due to dust was reported in 8 (53.4%) subjects in the study group and allergy due to pollens in 5 (33.3%) subjects in the control group. The majority of subjects, 7 (46.7%), had exposure to allergens for more than five years in the study group and control group. Most subjects had a duration of illness below one year: 5 (33.3%) in the control group and 4 (26.7%) in the study group. The article reports that the majority of

subjects did not have comorbid illnesses. Regarding regular treatment, 7 (46.7%) subjects in the study group received regular treatment, whereas 10 (66.7%) subjects in the control group were not taking regular medication. In the control group, 7 (46.7%) subjects received allopathic treatment and 5 (33.3%) received homeopathic treatment.

SECTION B: DETERMINING THE EFFECT OF PULMONARY REHABILITATION

Clinical Measurement of COPD

The results of the paired Student's *t*-test showed a statistically significant increase in mean pulse rate and a decrease in respiratory rate, respectively, in the study group ($p < 0.05$).

Pulmonary Function Test

Pulmonary function was assessed before the breathing exercises. The detailed results

are presented in the following section of the article.

PULMONARY FUNCTION TEST

Pulmonary function was assessed before the breathing exercises. The overall mean FEV₁ was approximately 0.11 ± 0.42 in the study group and 0.03 ± 0.22 in the control group. There was a decline of 0.70 ± 0.07 litres in FVC in the study group and a similar decline of 0.22 ± 0.11 in the control group. The FEV₁/FVC ratio increased by 2.8 ± 9.5% in the study group, while the control group showed a decline of 0.55 ± 3.85%. These changes were not statistically

significant when the study and control groups were compared (p = 0.2666).

SIX-MINUTE WALKING TEST

The mean six-minute walking distance (6MWD) in the pulmonary rehabilitation group during the initial period was 300.05 ± 85.00 metres. At the end of 12 weeks, it significantly improved to 320 ± 87 metres (p < 0.001).

The mean 6MWD in the control group was 290 ± 45.45 metres at baseline. At the end of 12 weeks, the value decreased to 250 ± 101 metres. The changes were statistically significant.

TABLE 2: MODIFIED BORG'S SCALE SCORE FOR DYSPNOEA AT BASELINE AND AFTER THE PULMONARY REHABILITATION PROGRAMME

Group	Dyspnoea at rest: baseline (Mean ± SD)	Dyspnoea at rest: after intervention (Mean ± SD)	Post-exercise dyspnoea: baseline (Mean ± SD)	Post-exercise dyspnoea: after intervention (Mean ± SD)
Study (n = 15)	1.55 ± 0.99	0.29 ± 0.26	3.50 ± 1.30	1.20 ± 1.05
Control (n = 15)	1.30 ± 1.00	1.25 ± 1.00	5.00 ± 2.50	4.30 ± 2.45

SECTION C: EFFECT OF PULMONARY REHABILITATION ON QUALITY OF LIFE IN PATIENTS WITH COPD

The SGRQ symptoms score improved by 19.15 ± 6.70 in the study group compared with the control group (3.35 ± 4.15). The SGRQ symptoms score in the study group receiving the pulmonary rehabilitation programme was statistically significantly better than that in the control group (p < 0.001).

Patients receiving pulmonary rehabilitation showed greater improvement (4.00 ± 5.57) in the SGRQ activity score compared with the control group (0.68 ± 1.70). The study group showed significant improvement (p = 0.000) in the SGRQ activity score.

An improvement of 12.04 ± 6.99 in the SGRQ impact score was observed in the study group, while an improvement of 0.24 ± 0.88 was also present in the control group. Improvement in the total SGRQ score from baseline after pulmonary rehabilitation was

13.88 ± 4.99 in the study group, compared with 0.74 ± 1.70 in the control group.

SECTION D: ASSOCIATION BETWEEN QUALITY OF LIFE IN PATIENTS WITH COPD AND SELECTED DEMOGRAPHIC PROFILES

No significant association was found between the control and study groups with respect to demographic characteristics (p > 0.05). The chi-square test showed a significant association between selected demographic characteristics—history of exposure to smoke, duration of exposure to pollutants, and duration of illness—and group allocation (p < 0.05). The remaining characteristics were not statistically significant (p > 0.05).

DISCUSSION

Mancini et al. studied the effects of a 12-week pulmonary rehabilitation programme on an outpatient basis. The findings of the

present study support the conclusion that pulmonary rehabilitation can lead to significant improvement in quality of life, as measured by the St George's Respiratory Questionnaire.

A critical review and meta-analysis of the long-term effects of pulmonary rehabilitation in patients with COPD detected a significant improvement in six-minute walking distance after pulmonary rehabilitation, corresponding to a mean improvement of 49 metres.

Barakat et al. evaluated the effects of pulmonary rehabilitation in patients at baseline and at the end of 14 weeks. The results were comparable with those of the present study.

A pre-experimental study was conducted on breathlessness in patients with COPD. Dyspnoea was assessed using the Modified Borg Scale. The study showed that deep-breathing exercises are effective in reducing dyspnoea in patients with COPD.

CONCLUSION

The study reveals that pulmonary rehabilitation improves quality of life in patients with chronic obstructive pulmonary disease (COPD) across all domains of the St George's Respiratory Questionnaire, including symptoms, activity, and impact. Greater impairment was observed in patients who were not receiving pulmonary rehabilitation. Pulmonary rehabilitation provided by medical professionals improves the quality of life of patients with COPD.

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