Pulmonary Rehabilitation in Patients with Chronic Obstructive Pulmonary Disease

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ABSTRACT

Background. Chronic obstructive pulmonary disease (COPD) is a major cause of morbidity and mortality in India. Drug treatment alone does not optimize therapy. Pulmonary rehabilitation has been found to improve the physical efficiency of COPD patients. Therefore, we evaluated the effect of domiciliary pulmonary rehabilitation programme in patients of COPD.

Methods. Forty patients of stable COPD having severe airflow obstruction were included in the study. They were divided into control and experimental groups randomly. Rehabilitation included walking, breathing exercises, postural drainage, controlled coughing and changes in life style activities. Exercises of 30 minutes duration were performed at home twice daily for four weeks supervision. Six-minute walking distance, forced expiratory volume in one second (FEV$_1$) and various indices of chronic respiratory disease questionnaire (CRDQ) were measured in both experimental and control groups before and after completion of the study.

Results. In the experimental group, after four weeks, the mean (±SD) difference in six-minute walking distance, dyspnoea, mastery, fatigue and emotion scores were 54.2 (26.7) meters, 0.96 (0.26), 0.89 (0.44), 0.90 (0.40) and 0.91 (0.32) respectively. Changes in all these parameters were statistically significant (p<0.001) as compared to the control group. There was no significant change in FEV$_1$.

Conclusion. It was concluded that domiciliary pulmonary rehabilitation for four weeks results in significant improvement in the quality of life and exercise tolerance, even without improvement in FEV$_1$.

Key words: Pulmonary rehabilitation, COPD, Exercise tolerance, Physiotherapy.

INTRODUCTION

Chronic obstructive pulmonary disease is the biggest cause of unnatural death in rural India and its prevalence continues to increase. Widespread habit of smoking and the use of cowdung and wood as cooking fuel have led to such a high prevalence of COPD. The associated loss of physical capacity and the adverse psychological effects of the disorder contribute greatly to morbidity. Medicines have a limited role in improving the physical capacity of patients with COPD. However, rehabilitation programmes have been found to increase exercise tolerance and improve quality of life.

In comparison to a hospital setting, domiciliary rehabilitation has been preferred...

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since it is more convenient for patients as they
stay at home and remain in touch with their
families and apply training in their life style.5,6
Though domiciliary pulmonary rehabilitation
has been found to be effective, this mode of
therapy has not been evaluated in Indian
patients.

Therefore, to evaluate the effect of domiciliary
respiratory rehabilitation in patients with
COPD, we undertook this study.

MATERIAL AND METHODS

This study was carried out in the Pulmonary
Research Laboratory, Department of Medicine,
SMS Medical College and Hospital, Jaipur. Forty
patients of stable COPD with severe airway
obstruction were included in the study. Patients
of chronic bronchitis and/or emphysema
having FEV₁/FVC ratio less than 0.7 and FEV₁
less than 40 per cent of the predicted, had
dyspnoea in three or more daily activities been
never involved in a pulmonary rehabilitation
programme and had given up smoking for at
least two months, were included in the study.
Patients with right ventricular failure, unstable
ischaemic heart disease, oxygen saturation less
than 88% at rest, musculoskeletal diseases, acute
exacerbation and pneumothorax were excluded.

The patients included in the study were
divided randomly into experimental and control
groups. The patients in the experimental group
were given training on pulmonary rehabili-
tation. The control group patients were asked to
continue their activities as usual. Physical
capacity and wellbeing of the patients were
evaluated by monitoring FEV₁, distance walked
in six-minute and indices of CRDQ.7 In both the
groups these parameters were evaluated on two
occasions before baseline measurement, and
after completion of four weeks schedule.

FEV₁ was measured on vica test spirometer.
Bronchodilators were stopped six hours before
arrival in the laboratory. In the six-minute
walking distance test, the subjects were asked to
walk as far as they could in six-minute with
standardised encouragement and in a covered
corridor. The distance was measured in meters.8

Quality of life has increasingly recognised as
an important outcome of medical interventions.
It can be measured by a questionnaire based tool
called chronic respiratory disease questionnaire.
The CRDQ as developed by Guyatt and
colleagues9 was translated into Hindi and used
for quality of life assessment. The Hindi version
of the CRDQ was pre-tested. Original English
and Hindi versions of the questionnaires were
given to COPD patients knowing both the
languages on two separate occasions. The
responses of questionnaire in the two languages
showed good correlation. The questionnaire
included questions to assess various indices of
health related quality of life. It included
assessment of severity of dyspnoea, fatigue,
emotional functioning and mastery (feeling of
control over disease). These were measured on
a scale of 1 to 7 from “very high” to “nothing at
all” for each index. Each domain had four to
seven items.

Methods of Pulmonary Rehabilitation

In pulmonary rehabilitation schedule, the
patients were trained in removal of secretions,
lower extremity exercises, breathing strategies
and energy conservation and work simplification.
The techniques were as follows:

1. Breathing strategies

(a) Pursed lip breathing: Patients inhaled
through the nose with mouth closed, and then
exhaled through mouth with lips pursed
tightly. The exhalation was twice as long as the
inhalation.

(b) Diaphragmatic breathing: The patients
were asked to exhale slowly through pursed lips
while drawing the abdomen inward, and inhale
slowly through the nose so that the abdomen
would expand outward.

2. Removal of secretions

(a) Controlled coughing: Patients took slow
and deep breath by using diaphragmatic
breathing. Then they coughed twice after a
pause with the mouth slightly open.
(b) Postural bronchial drainage.  
- Conditioning was done by enhancing fluid intake, use of bronchodilators and inhalation of moist air.  
- Drainage position: The patients were advised to adopt various positions of postural drainage to facilitate gravity aided drainage. They breathed by pursed lip and diaphragmatic breathing techniques throughout the bronchial drainage period. They coughed after each position by controlled coughing technique.  

3. Lower extremity exercise  

The rehabilitation program consisted of lower extremity exercise in the form of walking. It was performed at home or on a flat track. Subjects were asked to walk as much as they could with a submaximal speed twice a day. During walking, they used pursed lip breathing.  

4. Energy conservation and work simplification of activities of daily living  

The patients were taught to breathe with pursed lip while they performed activities of daily living. Inspiration and expiration were also taught to be timed so as to minimize the work of breathing.  

The subjects in the experimental group were asked to follow the programme at home for 30 minutes twice a day. They were supervised weekly to ensure that they were following the rehabilitation schedule properly and taking regular treatment.  

Statistical Analysis  

The difference in various parameters, before and after rehabilitation therapy was calculated. Mean values of difference between experimental and control group were compared. Students “t” test was applied for evaluating the significance of differences.  

RESULTS  

Forty patients participated in the study. Their mean age was 59.37 ± 6.4 years (range 48 to 75 years). Out of these 32 (80%) were males and 8 (20%) females. Twenty patients were included in each group, control and experimental.  

Both the control and the experimental groups were comparable in respect of age and sex, as well as their baseline forced expiratory volume in one second (FEV₁) and forced vital capacity (FVC). In experimental group, the mean (±SD) FEV₁ was 28% (7.5) while in the control group it was 26% (7.1) of the predicted value. The mean FEV₁/FVC ratio were 44% (16) and 48% (10.4) in the control and experimental groups, respectively. Mean difference before and after the program between experimental and control groups for FEV₁ was 1.1% (0.4) and 0.9% (0.5), respectively (see Table). The difference was not

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**Table. Various indices before and after rehabilitation program**

<table>
<thead>
<tr>
<th></th>
<th>6-min Walking</th>
<th>Dyspnoea Score</th>
<th>Emotional Score</th>
<th>Fatigue Score</th>
<th>Mastery Score</th>
<th>FEV₁ (% Predicted)</th>
</tr>
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<tbody>
<tr>
<td>Before</td>
<td>261 (113)</td>
<td>257.7 (158)</td>
<td>3.16 (1.0)</td>
<td>3.5 (0.82)</td>
<td>3 (1.1)</td>
<td>2.8 (0.9)</td>
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<tr>
<td>Mean (±SD)</td>
<td></td>
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<tr>
<td>After</td>
<td>315 (118)</td>
<td>264 (157)</td>
<td>4.12 (0.88)</td>
<td>3.58 (0.84)</td>
<td>3.9 (1.1)</td>
<td>3.7 (0.9)</td>
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<tr>
<td>Mean (±SD)</td>
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<tr>
<td>Mean Difference (±SEM)</td>
<td>54.2 (10.3)</td>
<td>6.7 (0.3)</td>
<td>0.96 (0.26)*</td>
<td>0.08 (0.18)</td>
<td>0.9 (0.3)*</td>
<td>0.15 (0.2)</td>
</tr>
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*P<0.001.
significant statistically.

Mean per cent increase in the distance covered in six-minute walk after the schedule was 20.7 (10) meters in the experimental group and 2.6 (4) meters in the control group.

The mean differences among various domains of CRDQ between experimental and control groups were: dyspnoea 0.96 (0.26) and 0.08 (0.18), emotional 0.91 (0.3) and 0.15 (0.2), mastery 0.89 (0.44) and 0.05 (0.2) and fatigue 0.9 (0.4) and 0.06 (0.2) (see Figure). The differences between control and experimental group were highly significantly (p<0.001).

Pulmonary rehabilitation has been found to be effective in a number of studies, however, patients have to remain in hospital for a long duration, thus inflating the cost of treatment besides causing inconvenience. Therefore, in the recent past, domiciliary rehabilitation trials have been carried out. These were also found to improve the patients' physical capacity and general wellbeing.

In the present study, there was a significant improvement in the distance covered in six-minute walk and health related quality of life, as measured by CRDQ questionnaire. If we extrapolate this increase in physical capacity and quality of life into the life style of a COPD patient, it can extend his activities from a house to the neighbourhood of the locality. It can bring about a significant change in the quality of life even without an improvement in FEV₁.

In COPD, exercise capacity is reduced as a result of weakness, breathelessness and abnormal psychology. With pulmonary rehabilitation exercise capacity has shown improvement. The improvement in exercise tolerance may be ascribed to improved aerobic capacity of muscle strength, increased motivation, desensitisation to sensation of dyspnoea, improved ventilatory muscle function and improved technique of performance. Several studies have found a correlation between exercise endurance and an improved feeling of wellbeing.

Not much work has been carried out regarding pulmonary rehabilitation of COPD patients in India. There are many problems in implementation the rehabilitation programs in India. Illiteracy, ignorance, poverty, lack of motivation, inclination towards drug therapy and smoking as a social custom are some of the obstacles in implementing such a program. However, our results showed usefulness of rehabilitation program despite all these adverse situations.

It can be concluded that domiciliary pulmonary rehabilitation is an effective and economical method for improving the physical capacity and general wellbeing of patients of COPD. The exercise tolerance can also be
improved despite the presence of irreversible structural abnormalities in the lung.

REFERENCES


