Short Communication

Effects of pulmonary rehabilitation on secondary polycythemia in stable chronic obstructive pulmonary disease: A pilot study

Gajendra Vikram Singh, Rajendra Prasad[1], Surya Kant[2], Santosh Kumar[2], Narsingh Verma[3], Ved Prakash[2], Ajay Kumar Verma[2], Santosh Kumar, Arpita Singh[4]

Department of TB and Chest Diseases, Sarojini Naidu Medical College, Agra, [1]Vallabhbhai Patel Chest Institute, University of Delhi, Delhi, [2]Department of Pulmonary Medicine, King George's Medical University, Uttar Pradesh, Lucknow, [3]Department of Physiology, King George's Medical University, Uttar Pradesh, Lucknow, [4]Department of Pharmacology, Ganesh Shankar Vidyarthi Memorial Medical College, Kanpur, Uttar Pradesh, India

Abstract

Chronic obstructive pulmonary disease (COPD) is a major health issue worldwide. Secondary polycythemia is common in COPD. There are reports of improvement in pulmonary functions by various rehabilitatory pulmonary exercise programs. However, the effect of pulmonary rehabilitation on secondary polycythemia has not yet been fully assessed. Therefore, in the present study, we investigated the effect of a short course (10 weeks) of pulmonary rehabilitation program (PRP) on secondary polycythemia in 26 subjects, divided into cases (n = 14) and controls (n = 12). In cases (those who received PRP), the percentage decrease in hematocrit was significant compared to the controls (who did not receive PRP). This pilot study suggests that PRP could be beneficial in the treatment of COPD especially for decreasing hematocrit.

Key words: Chronic obstructive pulmonary disease, haematocrit, pulmonary rehabilitation, secondary polycythemia

Received: 22th April, 2014; ***Revised:*** 28th May, 2014; ***Accepted:*** 9th June, 2014

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a major public health problem and a common cause of morbidity and mortality throughout the world. It is currently the fourth leading cause of death in the world,[1] and further increase in the prevalence and mortality of this disease can be predicted in the coming decades. Persistent and progressive dyspnea, the hallmark symptom of COPD, is a major cause of disability and anxiety associated with this disease.[2] Weight loss and anorexia are also common problems in advanced COPD.[1,2] Exercise intolerance, a characteristic and troubling manifestation of this disease, is the result of a combination of exertional breathlessness and peripheral muscle weakness. This limitation reduces social interaction and promotes depression, which further worsens the impact of dyspnea. This "vicious cycle" of social isolation, depression, immobility, dyspnea, and lack of fitness in COPD contributes greatly to morbidity.[1,2]

Access this article online	
Quick Response Code:	Website: www.ijcep.org
	DOI: 10.4103/2348-8093.137420

Pulmonary rehabilitation program (PRP) has emerged as a recommended standard of care for patients with chronic lung disease based on a growing body of scientific evidence.[2-4] The principal goals of PRP is to reduce symptoms, decrease disability and handicap, increase participation in physical and social activities (functional independence), and improve the overall quality of life for individuals with chronic respiratory diseases while diminishing the health care burden.[4] These goals are achieved through several processes including exercise training, patient and family education, instruction in respiratory and chest physiotherapy techniques, dietetics, occupational therapy, energy conservation and work simplification techniques, psychosocial and behavioral intervention, and end of life education.[5]

Address for correspondence: Dr. Ajay Kumar Verma, Department of Pulmonary Medicine, King George's Medical University, Lucknow - 226 023, Uttar Pradesh, India. E-mail: drajay21@gmail.com

However, to the best of our knowledge, no study has been conducted to assess the beneficial role of PRP on secondary polycythemia. Therefore, the present study was conducted to establish the influence and the effect of PRP on secondary polycythemia.

MATERIALS AND METHODS

We evaluated 43 cases of COPD presented to the Department of Pulmonary Medicine, King George's Medical University, Lucknow for management.

Inclusion criteria

- COPD patients of GOLD stages 2, 3, and 4[2]
- Spirometry characteristics of COPD: Forced expiratory volume in 1 sec (FEV1)/forced vital capacity (FVC) <70% with change in pre and post bronchodialator FEV1 ≤200 ml and ≤12%
- History of risk factors such as smoking, occupational dusts and chemicals, smoke from home cooking
- Age ≤ 75 years
- Stable patients who had not experienced an exacerbation or been hospitalized in previous month while the patient was receiving an acceptable medical regimen according to the GOLD recommendation.

Spirometry was done in our Department of Pulmonary Medicine owned spirometer "Spiro 233" (P K Morgan company from Belgium) and the FEV1/FVC <70% with change in pre and post bronchodialator FEV1 ≤200 ml and ≤ 12% confirmed diagnosis.

After confirming diagnosis, 26 stable patients, who had given their consent to participate in study were included in study group (n = 14; those who received PRP plus standard medical therapy) and control group (n = 12; those who received standard medical therapy alone) by randomization.

After baseline assessment of all patients, patients in the study group were put under PRP, which was individually tailored and in accordance with standard evidence-based guidelines.

The interventions used were variants of exercise regimens such as physical reconditioning, breath retaining exercises, exercises for bronchial hygiene, health education, dietetics, and psychosocial support completed the whole range of PRP. Patients were assessed and supervised every 2 weeks for a total duration of 10 weeks.

Patients in both groups were given pharmacological COPD treatment according to GOLD guidelines[2] including bronchodilator. Exacerbations were managed the similar way. The hematocrit was measured by Wintrobe method[6] in both the study and control groups at the baseline (before PRP) and after PRP.

Data were expressed as Mean ± SD. The statistical analysis of the data was carried out using the GraphPad InStat softwares (GraphPad Software Inc., San Diego, CA, USA). Student's paired and unpaired '*t*' was used to test the difference between the groups. $P < 0.05$ was considered significant.

RESULTS

Age, pulmonary function parameters and hematocrit, when compared between cases and control were not statistically significant ($P = 0.6481$) at baseline [Table 1].

There was a decline in hematocrit as measured by Wintrobe method in patients receiving PRP from baseline, after rehabilitation program, while an increment in hematocrit was observed in patients of control group [Figure 1]. However, this difference between the groups was not statistically significant.

We observed a significant decrease ($P = 0.0055$) in hematocrit percentage (Mean ± SD: 3.77 ± 5.80%) in patients of study group after the PRP while an increment of hematocrit percentage (Mean ± SD: 2.38 ± 4.33%) was observed after the study in patients of control group [Table 2].

DISCUSSION

COPD is a chronic disease with some significant extra-pulmonary effects that may contribute to the severity in individual patients. Its pulmonary component is characterized by airflow limitation that is not fully reversible. The airflow limitation is usually progressive and associated with an abnormal inflammatory response of the lung to noxious particles or gases.[2]

Table 1: Comparison of differences in age, pulmonary function parameters and hematocrit, between study and control groups

Parameters	Control group	Study group	*P* value
Age	58.71±9.86	56.50±7.21	0.5262
FVC (post bronchodilator)	2.20±0.59	2.10±0.68	0.6086
FEV1 (post bronchodilator)	1.13±0.38	1.03±0.42	0.5511
FEV1/FVC	53.17±12.48	48.58±8.06	0.2851
Hematocrit	43.39±6.36	42.21±6.56	0.6481

FVC: Forced vital capacity, FEV1: Forced expiratory volume in 1 sec. Data were expressed as mean±SD. Student's unpaired '*t*' was used to test the difference between the groups. $P<0.05$ was considered significant

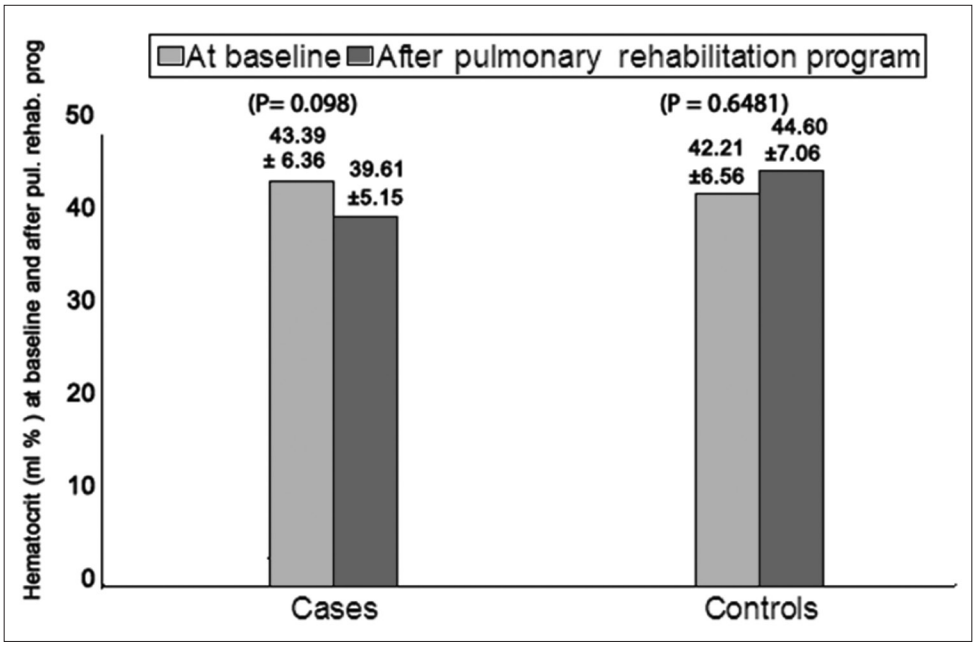

Figure 1: Comparison of hematocrit levels after pulmonary rehabilitation

Table 2: Comparison of difference in hematocrit percentage after PRP in both the groups

Group	Difference in hematocrit (mean±SD)	*P* value
Cases (*n*=14)	−3.77±5.80	0.0055
Controls (*n*=12)	2.38±4.33	

Data were expressed as mean±SD. Student's unpaired '*t*' was used to test the difference between the groups. *P*<0.05 was considered significant

Secondary polycythemia is traditionally viewed as a typical of COPD and leads to an increase in blood viscosity, metabolic acidosis, increased thrombogenocity, and higher incidence and severity of coronary disease and stroke in these patients.[7-10] While blood viscosity increases concomitantly with the hematocrit reading at all levels of the hematocrit, the rate of viscosity rise accelerates when the haematocrit reading is in excess of 60%.[11-13] Pulmonary rehabilitation is a "multi-disciplinary program of care for patients with chronic respiratory impairment that is individually tailored and designed to optimize physical and social performance and autonomy".[5] In the present study, though there was no considerable decrease in hematocrit in COPD patients who received PRP [Figure 1], the percentage decrease in hematocrit was statistically significant in the patients compared to the controls [Table 2]. This could be due to less sample size and shorter duration of PRP. However, findings of this pilot study indicate that there was some improvement in the general conditions of these COPD patients, which could be attributed to decrease in hematocrit.

PRP can be administered in in-patient, out-patient, home settings, or some combination of these. As we observed, PRP significantly improved hematocrit and thereby secondary polycythemia in COPD. Further research should be done in larger sample size to establish the specific benefits of PRP.

PRP has a positive influence over not only secondary polycythemia but also in various other objective and subjective parameters. Parameters other than secondary polycythemia can be studied further, which can enhance and advertize the favorable outlook of pulmonary rehabilitation.

CONCLUSION

From the present study, we conclude that stable patients of COPD with functional limitation are potential candidates for PRP. Physical training, exercise for bronchial hygiene, breathing, retaining, health education, dietetics, and psychosocial support should be incorporated in an effective comprehensive PRP for COPD. Duration of 10 weeks could be sufficient for an effective PRP. PRP can help to reduce the secondary polycythemia in COPD patients and thus improve blood viscosity, which can secondarily improve cardiac function. Therefore, a comprehensive PRP may be considered for overall management of secondary polycythemia in COPD along with recommended pharmacological treatment.

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How to cite this article: Singh GV, Prasad R, Kant S, Kumar S, Verma N, Prakash V, *et al*. Effects of pulmonary rehabilitation on secondary polycythemia in stable chronic obstructive pulmonary disease: A pilot study. Int J Clin Exp Physiol 2014;1:157-60.

Source of Support: Nil, **Conflict of Interest:** Nil.