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Original Research Paper

Pulmonary Medicine

EFFECT OF PULMONARY REHABILITATION IN PATIENTS OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE: A HOSPITAL BASED CROSS SECTIONAL STUDY

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ABSTRACT

BACKGROUND: Chronic obstructive pulmonary disease(COPD) is an obstructive and progressive airway disease associated with reduction in daily physical activity and psychological problems related to patient's disability and poor quality of life. Pulmonary rehabilitation(PR) plays an essential role in the management of COPD, by breaking the vicious circle of dyspnea–decreased activity–deconditioning–isolation.

AIM: This study aimed to highlight the impact of PR on COPD patients while focusing on the clinical usefulness of PR.

MATERIALS & METHODS: This study was done over a period of 1.5 years including all the diagnosed cases of COPD (both OPD and IPD) who did not have any acute exacerbation requiring oxygen, not associated with other medical conditions such as heart disease, neurological disease, lumbar spondylitis or osteoarthritis or those unable to perform PFT after taking proper consent. The study was completed with a follow up schedule, monthly, for 3 months. Proforma for the study included demographics, history, examination, dyspnea grading using modified Borg scale as well as CAT questionnaire along with a six-minute walk test and spirometry. Statistical analysis was done using SPSS Version 20 (Chicago Inc., USA). Data comparison was done by applying specific statistical tests to find out the statistical significance of the comparisons. Quantitative variables were compared using mean values and qualitative variables using proportions. Significance level was fixed at $P < 0.05$.

RESULTS: Out of total 227 cases, only 71 completed the 3-month monthly follow up and hence were used for the statistical analysis. The results showed male:female ratio 80.3:19.7. As per Borg scale, mean fever, chest pain, cough, expectoration and dyspnea score decreased over subsequent follow-up. Rate of hospitalisation was seen more in 61-70 year age group. Mean six-minute walk test value increased continuously during the duration of follow up.

CONCLUSION: Effective pulmonary rehabilitation that incorporates exercise schedules and patient education compreh ensively can encompass treatment and improve the quality of life of patients suffering with COPD.

KEYWORDS : Copd, Pulmonary Rehabilitation, Dyspnea, Fev1

INTRODUCTION

The prevalence of Chronic Obstructive Pulmonary Disease (COPD) is constantly increasing, while its incidence is gro wing in old age.[1,2,3] COPD is also a leading cause of morbidity worldwide, particularly in developing coun tries.[1]For a long time, the treatment of COPD has focu sed mainly on pharmacological improvement of the airw ay obstruction. However over the last two decades, gro wing evidence of systemic manifestations in COPD patients and their negative effects on the functioning of these patients has accelerated the development and use of no n-pharmaco logical treatments, such as pulmonary rehabi litation (PR). Moreover, PR has been shown to be the most effective non-pharmacological intervention for improving health status in COPD patients and has become a stan dard of care for COPD patients.[3] PR and pharmac ological factors are not competitive. Instead, PR works best when collaborated with anticholinergics bronchodilators.[4] COPD patients are disabled by the systemic manifes tations of the disease, the most significant being the perip heral muscle dysfunction resulting from both physical inactivity and systemic inflammation, in addition to hypo xemia, [5,6] This study aimed to present the use of PR in COPD and to highlight the impact of PR on patients with COPD, focusing on the clinical usefulness of PR, which provides patients a favourable environment for optimising therapy.

MATERIALS & METHODS

The study was conducted in a tertiary care hospital of central India over a period of 1.5 years stretching from January 2015 to July 2016. All the patients diagnosed with COPD were included in the study (both OPD and IPD). Non-consenting patients, those getting admitted with acute exacerbation requiring oxygen and those with other medical conditions (cardiovascular diseases, neurological conditions, lumbar spondylitis, osteoarthritis) were excluded from the study.

The study proforma consisted of demographic characteristics, history, general & respiratory examination, Borg scale for symptoms and dyspnea grading along with a CAT questio nnaire, six minute walk test and PFT. CAT questi onnaire provides a simple and reliable measure of overall COPD-related health status for the assessment of individual patients. PFT was done after proper instructions and explanation through a video. The patients were categorised into groups A, B, C, D on the basis of combined COPD asses sment.[7] Counselling was done regarding regular practice of PR. Patients were followed monthly for a total period of 3 months and data was recorded on each visit.

Statistical analysis was done using SPSS v20 (Chicago Inc., USA). Chi-square test and ANOVA test were applied for result compilation. Quantitative variables were compared using mean values and qualitative variables using proportions. Significance level was fixed at $P < 0.05$.

RESULTS

Out of total 227 cases that were included in the study, only 71 completed the 3-month follow up and hence data compilation was done using these patients only.

Demographic data showed predominance of males(80.3%) in the study cohort with most subjects falling in the age group 61-70 years(43.7%).

As determined by the Borg scale, the severity of cough, expectoration and dyspnea continuously decreased in patients of COPD on pulmonary rehabilitation with the results showing statistically significant improvement in these symptoms with p values being 0.001 for each of these

parameters. Mean chest pain score also decreased during the course of study with slight rise at the end of third month. However, the decrease was statistically significant with (p= 0.001). Mean fever score also remained zero during subsequent follow up in most patients (p=0.001).

Co-morbidities associated with patients was mainly diabetes(12.7%) and hypertension(8.5%). Chest of about 77.5% patients was emphysematous. Out of 71 patients, 61(85.9%) were smokers and pack-year was 41-60 amongst most of the subjects(45.1%). Association of rates of hospitalisation with COPD severity also showed statistically significant results with increasing rates of hospitalisation in greater severity of COPD (p=0.001).

Around seventy-six percent patients experienced improv ement in their psychological status. Improvement in six-minute walk test and PFTs also showed statistically significant results with p=0.001.

Variable	Value	'p' Value	Anova
Age			
50-60 Years	42.3%		
61-70 Years	43.7%		
>70 Years	14.1%		
Sex			
Males	80%		
Females	20%		
Copd Severity			
A	21.1%		
B	29.6%		
C	22.5%		
D	26.8%		
Mean Cough Score		0.001	255.262
Day 1	4.35		
1 Month	3.15		
2 Month	2.42		
3 Month	1.61		
Mean Expectoration Score		0.001	232.238
Day 1	3.21		
1 Month	1.96		
2 Month	1.49		
3 Month	0.94		
Mean Dyspnea Score		0.001	333.711
Day 1	6.65		
1 Month	4.55		
2 Month	3.69		
3 Month	3.21		
Mean Chest Pain Score		0.001	29.826
Day 1	0.96		
1 Month	0.21		
2 Month	0.20		
3 Month	0.31		
Mean Fever Score		0.001	39.040
Day 1	1.11		
1 Month	0.03		
2 Month	0.23		
3 Month	0.00		
Co-morbidities			
No Disease			
Diabetes	68.8%		
Mellitus	12.7%		
Hypertension	8.5%		
History Of Hospitalisation	A	B	C	D	0.001	88.092
0/YR	14.1%	1.4%	1.4%	0		
1/YR	7%	28.2%	4.2%	0		
2/YR	0	0	12.7%	16.9%		
3/YR	0	0	4.2%	9.9%		
Shape Of Chest						
Normal	22.5%					
Emphysematous	77.5%					
Smoking Habit						
Yes	85.9%					
No	14.1%					
Pack Year						
0-20	18.3%					
21-40	22.5%					
41-60	45.1%					
61-80	14.1%					
Psychological Status						
Same	23.9%					
Improved	76.1%					
Mean Cat Score					0.001	290.635
Day 1	22.42					
1 Month	20.17					
2 Month	18.21					
3 Month	17.14					
Mean 'six-minute Walk Test' Score					0.001	45.748
Day 1	264.79					
1 Month	273.59					
2 Month	275.90					
3 Month	280.76					
PFT/FEVL Score	49.65				0.001	
Before Pr	50.25					
After Pr						

DISCUSSION

For a long time, COPD was considered to be a respir atory disease, mainly caused by tobacco smoking and leading to progressive dyspnea. However, additionally, COPD produces inactivity, which promotes further loss of exercise capacity through the loss of muscle mass, creating a vicious circle. Inactivity leads to deconditioning, mainly caused by breathlessness. This breathlessness leads to an increased fear of exertion and an avoidance of physical and social activities, thrusting the patient into a vicious circle leading to further isolation and depr ession, accompanied by a reduced QoL. Pulm onary rehab ilitation is a comprehensive intervention based on a thorough patient assessment followed by patient tailored therapies, which include, but are not limited to, exercise training, education and behaviour change, designed to improve the physical and emotional condition of people with chronic respiratory disease and to promote the longterm adherence of health-enhancing behaviours.[8] PR thus establishes a personalized and global treatment for the symptomatic COPD patient. Through our study, we aimed to compare the effects of pulmonary rehabilitation on the overall symptomatic and psychological improvement of the patients. A total of 227 patients fulfilled the inclusion criteria. However, only 71 patients completed the 3 month follow up and rest 156 dropped out of the study. Of these, majority were males and of the age group 61-70 years. Gender bias could be explained by the nature of the study which was hospital-based and it is difficult for females coming from remote locations to adhere to repeated follow ups. Age group could be explained by the nature of the disease which is more common in elderly. As we classified our patients on basis of combined COPD assessment in A,B,C,D groups the maximum number of hospital admissions were found in C&D group. It was also observed that rate of hospitalization was seen more in 61-70 year old patients although it was

statistically insignificant. Co morbidities associated with COPD showed diabetes mellitus in 9(12.7%) and Hypertension in 6(8.5%) subjects. It has been observed in the ECLIPSE study that co-morbidities were significantly higher in patients with COPD than in smokers and never smokers.[9] Out of 71 subjects, most of patients 61(85.9%) were smokers and 14.1% were non smoker, with 41-60 pack year amongst most of the patients. Though tobacco smoking is the most important cause of COPD, the population-attributable fraction for smoking as a cause of COPD ranged from 9.7 to 97.9 per cent.[10] A Swedish cohort study had observed that population-attributable fraction for smoking as a cause of COPD was 76.2 per cent.[11] In another Denmark study, the reported population-attributable fraction as a cause of COPD was 74.6 per cent.[12] Thus, a significant proportional subjects with COPD had causes other than tobacco smoking. In our country, bidi smoking is an important factor in addition to cigarette smoking that causes COPD.[13] Co-morbidities were significantly higher in patients with COPD than in smokers and never smokers.[8] Chronic obstructive pulmonary disease is characterized by an accelerated decline in FEV1.[14] At the end of the PRP, there was no significant improvement in FEV1 as before pulmonary rehabilitation FEV1 was 49.65% ±20.76 and after pulmonary rehabilitation it was increased to 50.25 %±21.12. Mean % Change was 1.21% in COPD patients. Although a prospective study done by Hui et al. on 36 patients with COPD demonstrated that there was no change in the lung function after PRP.[15] A study done by Kobayashi et al. on 17 patients with chronic bronchial asthma demonstrated that after pulmonary rehabilitation, a significant improvement in FEV1, FVC, and PEFR was seen. This was probably due to bronchodilator effect in bronchial asthma.[16]

The 6MWT is a physical test of disability, which is used to assess the patient's ability to perform specific activities of daily living such as walking. In the present study, PRP led to improvement in the 6 min walking distance in all the patients with COPD as before pulmonary rehabilitation on day 1 it was 264.53 ± 98.15 meter and after pulmonary rehabilitation, it was continuously increasing and after three month it was increased to 304.93 ± 97.83 meter i.e. there is mean increase of 40.4 m in all groups. The minimum clinically important difference for the 6MWT has been estimated to be 30 m.[17] These findings are similar with the study done by Goldstein et al. who showed that the COPD patients receiving PRP walked more during a 6MWT than the patients receiving conventional treatment.[18]

Gosselink et al. showed that in COPD, patients receiving rehabilitation walked more during a 6MWT than those patients receiving drug treatment. In a mixed group of patients, Gosselink et al. showed that the 6 min walking distance and the cycling endurance time continued to improve after rehabilitation.[19] In a mixed group of patients, Cox et al. demonstrated significant improvements after a 3 months rehabilitation program in maximal load during cycling and 12 min walking distance, in comparison to a control group.[20] During subsequent assessments, the maximal workload and walking distance decreased gradually at 3, 9, and 21 months after rehabilitation, but remained significantly higher in those patients receiving the rehabilitation program. Strijbos et al. demonstrated that up to 3 months, after a 3-month hospital-based outpatient rehabilitation program in a group of COPD patients, significant improvements in maximal workl oad during cycling and 4 min walking distance was attained in comparison to baseline assessments.[21] The study done by Rossi et al. on patients with COPD demonstrated that, exercise tolerance (6MWT) significantly improved after 10 sessions and 20 sessions in comparison to the baseline.[22]

The COPD Assessment test (CAT) is a recently introduced instrument to assess health-related quality of life in COPD. We aimed to evaluate the longitudinal change in CAT following Pulmonary Rehabilitation Program (PRP) in short term of 3 months. During PRP total CAT score found continuously decreasing in subsequent follow-up from day 1 to end of 3 month in all groups. Dodd JW et al found that the CAT score is immediately responsive to Pulmonary Rehabilitation and remains improved at 6 month.[23] There is significant improvement after pulmonary rehabilitation on basis of other questionnaire like St. George's Respiratory Questionnaire. A prospective study done by Singh et al. on patients with COPD demonstrated that, SGRQ improved after PRP.[24] These findings are also in accordance with the study done by Finnerty et al. on patients with COPD, which showed the significant improvement in health status using the SGRQ total score after pulmonary rehabilitation.[25] A study done by Griffiths et al. on COPD patients showed a significant improvement favoring rehabilitation in the SGRQ.[26]

Borg scale is a category scale used to measure exertional and overall dyspnea. In all the patients, there was a significant decrease in the dyspnea. These findings correlate with the study done by O'Donnell et al. who demonstrated that dyspnea and fatigue, measured with a Borg scale during graded cycle exercise, decreased significantly in the treatment group receiving pulmonary rehabilitation.[27]

CONCLUSIONS

PR has certainly been demonstrated to provide beneficial effects on dyspnea, improvement in muscle strength and endurance, improvement of psychological status, reduction of hospital admissions, and improvement of QoL in COPD patients, with a gradual increase in daily physical activity and autonomy. Successful PR therefore requires behavioral changes which may be facilitated if they are enrolled in longer, comprehensive programs comprising interactions with a multidisciplinary team offering support, council, encouragement, and coaching.

ABBREVIATIONS

COPD- chronic obstructive pulmonary disease
PR- pulmonary rehabilitation
PRP- pulmonary rehabilitation programme
QoL- quality of life
FEV1- Forced expiratory volume in 1st second
MWT- minute walk test
CAT- COPD assessment test

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