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EFFECT OF PULMONARY REHABILITATION ON PULMONARY DISEASES AND ITS EFFECT ON MEDICATION USAGE: A PROSPECTIVE OBSERVATIONAL STUDY

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Abstract

Background: Pulmonary rehabilitation (PR) is a non-pharmacological, multidisciplinary intervention that helps people with chronic lung disease breathe and function better. This study examined the effect of PR on patients with pulmonary diseases and on their medication use, assessed with the Morisky Medication Adherence Scale.

Objectives: To evaluate the effect of pulmonary rehabilitation on pulmonary diseases and to assess the medication adherence among those patients.

Methods: A prospective observational study was conducted over 6 months in the Department of Pulmonary Medicine, SVS Medical College and Hospital, Mahabubnagar. Data were collected from 90 patients (98 cases were initially collected) using a data collection form, patient information leaflets (PIL) and the 8-item Morisky Medication Adherence Scale (MMAS-8). Twenty patients underwent PR (6-minute walk test, yoga asanas or breathing exercises) with pharmacist counselling. Adherence scores were recorded before and after rehabilitation.

Results: Of 90 patients, 46 (51.1%) were male and the 36–40-year group was the largest (35 patients, 38.9%). Bronchial asthma (33.3%) and bronchiectasis (31.1%) were the most frequent diagnoses, and 39 patients (43.3%) were smokers. Twenty patients (22.2%) underwent PR. The mean MMAS-8 score changed from 8.44 before to 5.64 after rehabilitation (mean difference 2.80; paired Student's t-test, $t = 12.08$, $df = 19$, $p < 0.0001$).

Conclusion: Pulmonary rehabilitation was associated with a marked change in medication adherence scores in patients with chronic lung disease resulting in increase in quality of life and decrease in medication adherence and resistance. Larger, controlled studies are needed to evaluate it in detail.

Keywords: Pulmonary rehabilitation; medication adherence; MMAS-8; chronic obstructive pulmonary disease; asthma.

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INTRODUCTION

The principal physiological role of the lungs is to supply oxygen to the tissues and remove carbon dioxide, the main by-product of metabolism. This is achieved through close matching of ventilation to perfusion across a very large gas-exchange surface [1,2]. When the airways or lung parenchymas are injured, this integrated function is disrupted: airway disease produces obstructive disorders such as asthma and bronchitis, whereas parenchymal injury produces restrictive or pulmonary vascular disease. Chronic lung diseases are characterised by airflow obstruction and an abnormal inflammatory response to long-term exposure to noxious particles and gases, particularly cigarette smoke, leading to mucus hypersecretion, tissue destruction, small-airway inflammation and fibrosis [8]. Common symptoms include

dyspnoea, chest tightness, wheeze and cough, and complications include respiratory failure, heart failure and systemic inflammation with skeletal-muscle dysfunction. Smoking, occupational dust and chemical exposure, air pollution, radon and asbestos are the main recognised causes.

Pharmacological treatment relies on bronchodilators, inhaled and oral corticosteroids, phosphodiesterase-4 inhibitors, theophylline, mucolytics and, during infective exacerbations, antibiotics. The benefit of these drugs depends on patients taking them as prescribed, and non-adherence is well documented in chronic respiratory disease [11,13,14].

Pulmonary rehabilitation has been defined as an evidence-based, multidisciplinary and comprehensive intervention for symptomatic patients with chronic lung disorders and some disability, aimed at reducing symptoms, optimising functional status, increasing participation and reducing health-care costs by stabilising or reversing systemic manifestations of the disease [21]. Its components include exercise training, education, breathing retraining, nutritional advice, psychological support and outcome assessment. Rehabilitation may be delivered in out-patient, in-patient or home-based settings, typically at least three sessions per week for 4–12 weeks.

This study was undertaken to evaluate the effect of pulmonary rehabilitation on patients with pulmonary diseases and its effect on their medication use.

2. MATERIALS AND METHODS

2.1 Study design, setting and duration

This was a prospective observational (comparative) study conducted for 6 months in the Department of Pulmonary Medicine, SVS Medical College and Hospital, Mahabubnagar, Telangana. Study was done in the year 2022 -23 from September to February with the appropriate ethical clearance (IEC/DHR-004/2023/1511)

2.2 Study population

Inclusion criteria were: all chronic pulmonary diseases; age above 20 years; presence of co-morbid diseases; in-patients and out-patients; and patients with autoimmune disorders. Exclusion criteria were: patients admitted to the surgical ward; pregnant women; patients with gynaecological problems; patients with psychological disorders; and patients with a history of blood transfusion. Written informed consent was obtained from all participants.

2.3 Data collection tools

Data were collected using a patient consent form, a data collection form for demographic details, validated patient information leaflets, physical examination, liver function tests, complete blood picture and the 8-item Morisky Medication Adherence Scale (MMAS-8). The MMAS-8 contains eight closed-ended questions (yes/no for the first seven items) that are worded to reduce the bias of positive responses by reversing the items related to the interviewee's adherence behaviour.

2.4 Study procedure

Ninety patients were included in the analysis (98 cases were collected during the study period; (9 were excluded due to lack of interest). Baseline medication adherence scores were measured. Patients who underwent pulmonary rehabilitation were counselled by a pharmacist about their disease, medications and the need for adherence, and were given a patient information leaflet. Rehabilitation consisted of a 6-minute walk programme, yoga asanas or breathing exercises. Adherence was reassessed with the MMAS-8 at two follow-ups at 20-day intervals and again after 6 months of rehabilitation, and the scores of the groups were compared.

2.5 Statistical analysis

Data are presented as numbers and percentages (of 90 patients) for categorical variables and as means for adherence scores. Before-and-after adherence scores were compared using the paired Student's t-test; $p < 0.05$ was considered significant. SPSS software version 8 have been used for statistical analysis and interpreting the results.

3. RESULTS

3.1 Patient characteristics

A total of 98 cases were collected over 6 months, of which 90 patients were analysed (8 patients were excluded from study). Males were slightly more frequent than females (51.1% vs 48.9%). Pulmonary disease was most frequent in the 36-40-year group (38.9%) and least frequent in the 31–35-year group (11.1%). Thirty-nine patients (43.3%) were smokers, 22 (24.4%) consumed alcohol, 77 (85.6%) were literate and 69 (76.7%) reported a history of drug allergy (Table 01).

Table 01: Baseline characteristics of the study population (N = 90)

Characteristic	Category	n	%
Gender	Male	46	51.1
	Female	44	48.9
Age (years)	21–25	28	31.1
	26–30	17	18.9

Characteristic	Category	n	%
	31–35	10	11.1
	36–40	35	38.9
Smoking	Smokers	39	43.3
	Non-smokers	51	56.7
Alcohol intake	Alcoholic	22	24.4
	Non-alcoholic	68	75.6
Literacy	Literate	77	85.6
	Illiterate	13	14.4
History of drug allergy	Present	69	76.7
	Absent	21	23.3

3.2 Type of pulmonary disease

Bronchial asthma was the most common diagnosis (33.3%), followed by bronchiectasis (31.1%), COPD (20.0%) and tuberculosis (15.6%) (Table 02).

Table 02: Distribution of pulmonary diseases (N = 90)

Disease	n	%
Asthma	30	33.3
COPD	18	20.0
Tuberculosis	14	15.6
Bronchiectasis	28	31.1

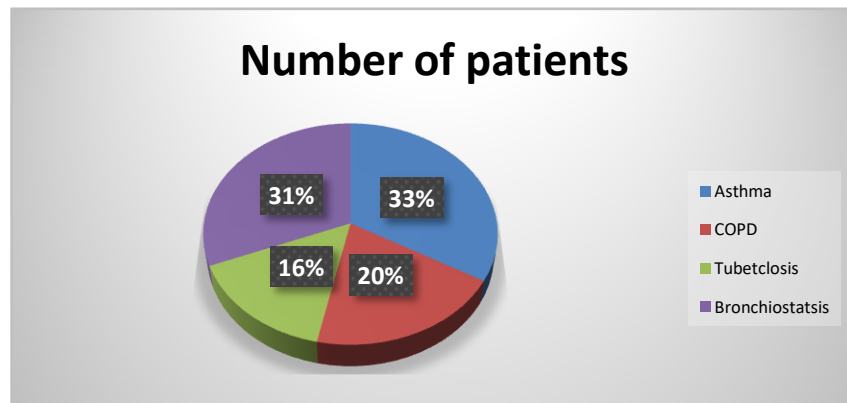


Figure 02: Distribution of pulmonary diseases (N = 90)

3.3 Pulmonary rehabilitation and exercise type

Twenty patients (22.2%) underwent pulmonary rehabilitation and 70 (77.8%) did not. The 6-minute distance walk was the most frequent exercise (51 patients), followed by breathing exercises (20) and yoga asanas (19) (Table 03).

Table 03: Participation in pulmonary rehabilitation and exercise type (N = 90)

Variable	n	%
Participated in pulmonary rehabilitation	20	22.2
Did not participate	70	77.8
6-minute walk test	51	56.7

Variable	n	%
Yoga asanas	19	21.1
Breathing exercises	20	22.2

3.4 Drug therapy

Bronchodilators were the most commonly used drug class (63 patients, 70.0%), followed by mucolytics (15.6%) and corticosteroids (14.4%) (Table 04). Among antibiotics, combination therapy was the most frequent (36.7%), followed by respiratory fluoroquinolones (23.3%), macrolides (21.1%), beta-lactams (13.3%) and cephalosporins (5.6%) (Table 05).

Table 04: Drug classes used (N = 90)

Drug class	n	%
Bronchodilators	63	70.0
Corticosteroids	13	14.4
Mucolytics	14	15.6

Table 05: Antibiotics used (N = 90)

Antibiotic class	n	%
Beta-lactams	12	13.3
Respiratory fluoroquinolones	21	23.3
Macrolides	19	21.1
Cephalosporins	5	5.6
Combination therapy	33	36.7

3.5 Dietary intervention

Dietary advice was categorised by food type; berries and oils (34.4%), vegetables (24.4%) and fruits (22.2%) were most frequent (Table 06). Categories are not mutually exclusive, so percentages exceed 100%.

Table 06: Dietary intervention (N = 90)

Type of food	n	%
Proteins	12	13.3
Probiotics	19	21.1
Nuts	2	2.2
Berries and oils	31	34.4
Coffee	5	5.6
Vegetables	22	24.4
Fruits	20	22.2

3.6 Effect on medication adherence

Among the 20 patients who underwent rehabilitation, mean MMAS-8 scores before and after rehabilitation by exercise type are shown in Table 07. Overall, the mean score was 8.44 before and 5.64 after the programme, a mean difference of 2.80 (SD 1.04; 95% CI 2.31 to 3.29). The paired Student's t-test showed a statistically significant change ($t = 12.08$, $df = 19$, $p < 0.0001$).

Table 07: Mean MMAS-8 score before and after pulmonary rehabilitation (n = 20)

Exercise type	Mean score before	Mean score after
6-minute walk test	8	5.80
Yoga	7	5.94
Breathing exercises	8	5.95
Overall (as reported in text)	8.44	5.64

Paired t-test (overall): mean difference 2.80, SD 1.04, $t = 12.08$, $df = 19$, $p < 0.0001$. SD of 1.0366 is the single value reported in the source table.

4. DISCUSSION

Pulmonary rehabilitation is a supervised programme combining exercise, education, support and behavioural intervention to improve everyday function and quality of life in people with chronic lung disease. In this study of 90 patients, 20 underwent rehabilitation.

Pulmonary disease was most frequent in the 36–40-year group, followed by the 21–25 and 26–30 groups, and least frequent in the 31–35 group. Males were slightly more affected than females, in line with other reports that men are more likely to develop pulmonary disease, with age and personal history being the most important risk factors followed by smoking, alcohol and tobacco use (Wouters et al.). Smoking was documented in 43.3% of patients, consistent with smoking being the leading cause of chronic lung disease; the remaining patients may reflect other causes such as infection, occupational exposure and air pollution.

Asthma and bronchiectasis together accounted for about two-thirds of the diagnoses. Bronchodilators were the cornerstone of treatment, and antibiotic use was dominated by combination regimens and respiratory fluoroquinolones, reflecting treatment of infective exacerbations.

The mean MMAS-8 score changed from 8.44 before rehabilitation to 5.64 after it. Which means patient is having better control over his symptoms without using much medications resulting in increase in quality of life of patients, reducing of excessive medication usage (resulting in decrease in antibiotic resistance, and cost effectiveness among patients). Rehabilitation delivered by walking programmes, yoga and breathing exercises with pharmacist counselling is a plausible mechanism for changing how patients use their medicines.

5. LIMITATIONS

The study was conducted at a single centre, the group undergoing rehabilitation was small ($n = 20$), allocation was not randomised, adherence was self-reported, and the follow-up period was limited. Confounders such as disease type and severity were not adjusted for. Larger studies are required for better observation.

6. CONCLUSION

Pulmonary rehabilitation was associated with a significant change in mean medication adherence score (8.44 to 5.64; $t = 12.08$, $p < 0.0001$) in patients with chronic lung disease, alongside the expected benefits of supervised exercise, education and counselling. The study also shows the decrease in medication adherence resulting in improving of quality of life, decrease of cost of medicine resulting in decrease in medication resistance. Larger randomised studies with objective outcome measures (spirometry, 6-minute walk distance, quality-of-life scores) are recommended.

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8. CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

9. ACKNOWLEDGEMENT

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10. AUTHOR CONTRIBUTES

Dr. Atiya Nasreen Tara conceived and designed the study, supervised the research work, and drafted the manuscript. Surabi Harsha, Rahilatarannum, Saniyanaaz, Chirumalla Sahithi Tasmiyanoorien, Koppu Dayakar, contributed to the data collection, analysis, and manuscript preparation. All authors reviewed and approved the final version of the manuscript.

11. ETHICAL STATEMENT

The ethical committee clearance was obtained from SVS Medical College and Hospital before initiating the study (Reference number: IEC/DHR-004/2023/1511).

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