Physical Capacity among Elderly Patients with Exacerbated Interstitial Lung Disease: Exercise Rehabilitation Protocol

Asmaa Ali Ahmed[1], Bedour Adel Mohamed[2], Aml A. Mohamed[3], Rokaia Fathy Mohamed[4], Marwa Mohammad Abd el baky[5]

1. Lecturer of Medical-surgical Nursing, (Critical Care Nursing), Faculty of Nursing- Minia University, Egypt.
2. Lecturer of Medical-surgical Nursing, Faculty of Nursing- Minia University, Egypt.
3. Lecturer of Medical-surgical Nursing, (Gerontological Nursing), Faculty of Nursing- Minia University, Egypt.
4. Assistance. Prof. of Medical-surgical Nursing, (Gerontological Nursing), Faculty of Nursing-Minia University, Egypt.
5. Assistance. Prof. of Medical-Surgical Nursing, (Critical Care Nursing), Faculty of Nursing-Minia University, Egypt.

Abstract

Background: Exercise therapy is a core component of pulmonary rehabilitation for `patients with interstitial lung disease to enhance cardiorespiratory fitness and physical capacity. **The study aimed to** evaluate the effect of a rehabilitation exercise protocol on physical capacity of elderly patients with exacerbated interstitial lung disease. **Research design:** A quasi-experimental research design (study/control) was utilized. **Setting:** The study was conducted in the chest intensive care unit, the chest department, and the chest outpatient clinic at Minia University Hospital-Egypt. **Sample:** A purposive sample of 86 elderly patients with exacerbated interstitial lung disease distributed equally into study and control group. **Tools:** Tool I: Patient health assessment included socio-demographic and medical data. Tool II: Functional Capacity Assessment involved (Six Minute Walk Distance Test, Modified Medical Research Council Dyspnea Scale, Katz Index of Independence in Activities of Daily Living and Oxford Scale for evaluating Muscle Strength). **Results**: The study group showed a significant increase in the mean score of distance walked after 8 weeks of rehabilitation protocol. In addition, it was observed that 0 % and 23.3 % of the study and control group had dyspnea after 8 weeks of implementing the rehabilitation protocol. As for, katz index scale, a statistical significance difference between the two groups was observed after 8 weeks of implementing the exercise rehabilitation. **Conclusion:** Application of rehabilitation exercise protocol documented a significant increase in physical capacity of elderly patients with exacerbated interstitial lung disease. **Recommendation**: Establishing exercise training programs for patients with exacerbated interstitial lung disease that contain multi-component interventions.

Key words: Physical capacity, Elderly, Interstitial Lung Disease, Rehabilitation Exercise Protocol.

Introduction

Numerous anatomical and functional changes within the respiratory system are part of the lungs' natural aging process (Baratella et al., 2023). (Podolanczuk and colleagues, 2021). Idiopathic pulmonary fibrosis (IPF) is much more common in elderly people, indicating that the likelihood of developing interstitial lung disease (ILD) rises with age (Schneider et al., 2021).

Uncommon and diverse set of disorders with a high death rate is referred to as exacerbated interstitial lung disease (EILD). Idiopathic pulmonary fibrosis (IPF), acute and chronic interstitial pneumonias, hypersensitivity pneumonitis, asbestosis, silicosis, sarcoidosis, and disorders associated with connective tissue diseases like rheumatoid arthritis and scleroderma are among the highly incapacitating conditions that make up EILD (Dowman et al., 2021).

People with EILD frequently experience extreme exhaustion and exertional dyspnea, which limits their ability to do daily duties. Patients frequently report increased degrees of weariness and dyspnea, as well as decreased physical function and energy. According to clinical guidelines around the world, pulmonary rehabilitation (PR) is a crucial treatment for people with EILD (Anan et al., 2024).

An integrated strategy called pulmonary rehabilitation can be started at any point in the course of the illness. It includes evaluating the patient, maintaining a regular exercise schedule, educating the patient, and changing their behavior. Hospital outpatient departments, critical care units, community health centers, inpatient institutions, and even homes can all be used to give pulmonary rehabilitation (Dowman et al., 2021).

Typically, resistance and endurance training are combined with aerobic activity to form exercise training. The goal of endurance training is to improve aerobic exercise capacity, which will raise tolerance to physical activity and lessen fatigue and/or dyspnea. Walking on a treadmill or down a hallway, as well as cycling, are examples of endurance exercise. If tolerated, both of these modalities are optimal. Walking is a useful workout that can increase one's ability to walk. Less exertional desaturation occurs when cycling (Bailey & DuBrock, 2024) (Dowman & May, 2020).

With an emphasis on aerobic activity, exercise training usually consists of both resistance and endurance training. By increasing aerobic capacity, endurance training aims to improve physical activity tolerance and lessen tiredness and dyspnea. Walking—on a treadmill or in a hallway—and/or cycling—both of which are beneficial if tolerated—may be a part of this workout. While cycling causes less exertional desaturation but offers a higher training stimulus to the quadriceps muscles than walking, walking, as a functional exercise, can increase walking capacity (Reouf et al., 2024).

The study's Significance

Exercise training as a component of pulmonary rehabilitation for older adults with exacerbated ILD has

demonstrated high benefits in reducing dyspnea, improving quality of life, increasing physical capacity and oxygen utilization, and fostering an overall sense of well-being. Previous related studies demonstrated a high prevalence of dependency and institutionalization among these individual (Dowman and others, 2021)

Significant variations in the incidence of ILD have been reported in different geographical areas. In North Belgium, the prevalence is 6.27 per 100,000 people, while in Greater Paris, it is 97.9 per 100,000. An incidence of 1 to 32 instances per 100,000 individuals per year has also been recorded by research carried out in Europe, the US, the Middle East, and Asia. Idiopathic pulmonary fibrosis (IPF) has the highest mortality rate, with a median survival of two to three years, while sarcoidosis has the lowest (Ye et al., 2023).

Minia University Hospital's census records for 2022–2023 show that 110 patients with ILD visited the hospital during this time. In contrast, no prior research has addressed this health concern in our region.

Research aim

The present study aimed to evaluate the effect of a rehabilitation exercise protocol on physical capacity of elderly patients with exacerbated interstitial lung disease.

Research hypothesis

The application of rehabilitation exercise protocol increase the physical capacity of elderly people with exacerbated interstitial lung disease in the study group compared with the control group.

Subjects and methods

Research Design: To achieve the study's goal, a quasi-experimental research design (study/control) was employed.

Settings: The study was carried out at the Chest Intensive Care Unit. The Cardiothoracic Surgery Hospital, which is part of Minia University Hospitals, Minia City, Egypt, provided follow-up care at the Chest department and outpatient clinic.

Subjects: A purposeful sample of 86 elderly patients with aggravated interstitial lung disease were specifically selected utilizing the non-probability sampling technique. The patients were divided into the control and study groups at an equal rate of forty-three patients each using a straightforward random sampling procedure

Sample size

The Slovin (1960) Formula, which is determined as (n = N / (1+Ne2), was used to determine the sample size.

n = size of the sample

N = total personnel

e = desired error margin

$n= 110 / [1+ (110) (0.05)^2 = 86$

Study group 43 patients + 43 patients for control group

Inclusion criteria

- Cases of both sexes with acute exacerbation interstitial lung disease who are 60 years of age or older
- Newly admitted to the Chest Intensive Care Unit.
- Conscious Patients who able to communicate.

Exclusion Criteria:

- History of syncope on exertion
- Severe orthopedic or neurological impairments
- Unstable cardiac disease
- Patients with visual and hearing impairments.

Tools of data collection

Following a review of the substantial literature, two tools were used

First Tool: Patient Health Assessment prepared by the researchers divided into two sections

- **1st Section**: **Demographic data** as age, gender, occupation and level of education.
- **2nd Section: Medical data** includes: date of admission and date of discharge, presence of chronic diseases, smoking and body mass index (BMI).

Second Tool: Functional Capacity Assessment: that had four components

Part I: 6 Minute Walk Distance Test

It was taken from Chen et al. (2015) and was used to find out how far a patient can walk quickly on a level, hard surface in six minutes without requiring more oxygen.

The details are as follows: After exercise, heart rate was measured using pulse oximetry, peripheral oxygen saturation (SPO2) was measured, and dyspnea was evaluated using the Modified Medical Research Council Scale. The test was terminated if the subject displayed any of the following symptoms: Dyspnea, fatigue, an elevated heart rate, chest pain or angina-like symptoms, or prolonged SPO2 < 85%

Scoring system

By multiplying the number of lengths by the track's length, the score determines how far a patient has walked.

Part 2: Modified Medical Research Council Dyspnea Scale (MMRC) adopted from (Nagata et al., 2012) used to assess the severity of dyspnea. This scale quantifies the level of exertion the patient is capable of before stopping due to breathlessness. Dyspnea is graded on a scale of 0 to 4, with 4 indicating that the patient experiences dyspnea on the slightest exertion

Part three: Katz Index of Independence in Activities of Daily Living used to evaluate Activity of daily living (Katz et al., 1963)

Six fundamental daily tasks are evaluated by the scale: clothing, toileting, food, bathing, transportation, and continence. A measure of ADL performance was obtained by adding the scores of the six activities, each of which was given a value of 0 (dependent) or 1 (independent).

Scoring System

Every client received a score for every one of the six functions. Full function (patient independence) is indicated by a score of 6, moderate impairment is indicated by a score of 4,

and severe functional impairment (patient high dependence) is indicated by a score of 2 or lower

Part four: Oxford Scale for evaluating Muscle Strength: (O'Neill et al., 2017)

A conventional scoring system with numbers ranging from 0 to 5 was used to assess muscle strength

Oxford Scale for Muscle Strength Scores	
0	No detectable muscle contraction (visible or palpation)
1	Detectable contraction (visible or palpation), but no movement achieved
2	Limb movement achieved, but unable to move against gravity
3	Limb movement against resistance of gravity
4	Limb movement against gravity and external resistance
5	Normal strength

Scoring System: The Oxford Scale ranges from 0 to 5. Full function (patient independence) is indicated by a score of five, while significant functional impairment (patient high dependence) is indicated by a score of zero.

Ethical considerations

To conduct this research, all official permits were obtained from the relevant authorities. After examining the research proposal, Minia University's Faculty of Nursing Ethics Committee approved the study. Every patient gave their free and informed consent. Patients were not at risk while the current study was being conducted, and they are free to decline to participate or to leave at any time without incurring any fees. During data gathering and encoding, anonymity, privacy, and secrecy were all guaranteed.

Content validity

In order to evaluate the research instruments' clarity, feasibility, and applicability, a panel of five experts in the fields of medicalsurgical nursing, gerontological nursing, rehabilitation, and physical medicine reviewed the.The panel included nursing specialists with over ten years of experience.

Reliability

- Reliability was ascertained statistically by using Alpha Cronbach test to ensure that the study tools are reliable as shown in the following table:

Tools	Cronbach's alpha
6 Minute Walk Distance Test	0.876
Modified Medical Research Council Scale	0.756
Katz Index of Independence in Activities of Daily	0.893
Oxford Scale for Muscle Strength	0.798

Pilot study

A pilot study was conducted on ten percent (n = 9) of the total research sample to test the clarity and applicability of the tools and determine the time required for completing it. There were no changes made, so the trial sample was included in the basic sample.

Study Procedure

The present study was achieved through 3 phases:

The preparatory Phase

After reviewing the existing and prior relevant literature in the field using textbooks, journals, articles, periodicals, and the internet to have a clear picture of all aspects related to the topic of research, such as Reouf et al. (2024), the current study started by preparing the data collection tools.In order to organize and set up the processes for recruiting and data collection, the researchers went to the chosen location prior to data collection.In addition to the official paper agreement that was obtained one month prior to the commencement of the research, this step assisted in planning, leading, guiding, and establishing the nursing protocol.Patients who agreed to take part in the current study gave their oral consent.

Study duration

The current research data was collected over duration of six months with frequency three days a week, from the first of May 2023 to the end of October 2023.

Implementation phase

In order to establish a baseline assessment that included age, sex, and the presence of chronic diseases (tool one), the researchers began interviewing each patient on an individual basis as well as their family members 24 hours after the patients were admitted to the chest intensive care unit and after they were deemed medically stable.The current study involved screening all participants for functional capacity using the 6 MWDT, measuring dyspnea usingthe modified Medical Research Council scale, measuring muscle strength using the Oxford Scale for Muscle Strength (tool two), and measuring activities of daily living using the Katz Index of Independence in Activities of Daily Living.At baseline, the participants' physical functioning were evaluated by the researchers.Eligible participants were randomized to either the control group or the exercise rehabilitation group after the initial baseline evaluation.

Study group

Applying physical training for patients with exacerbated interstitial lung disease: this training formulated by the researchers after revising extensive relevant literature review. This training was applied to improve the patients' physical functions; it was designed in the form of power point

The study group patients (43) were divided into 4 small groups. Each group consists of eleven or ten patients. Each small group received four sessions: two for assessment of the patients' physical capacity and enhancing the patients' knowledge about the interstitial lung disease, its definition, causes, risk factors and management and prevention of exacerbation recurrence and another two sessions focused on the importance of physical training and the ideal performance of various types of rehabilitative exercise training. Each session take (30 – 45 minute)

The demonstration and re-demonstration were carried out to ensure that the participants and their relatives can follow this procedure perfectly. All patients in the study group received a brochure in a simple Arabic language, containing photos and illustrations about knowledge and practice included in rehabilitative protocol to help the patients and their caregivers understanding this training.

The patients performed physical exercises during their staying in the hospital, and after discharge, during their

attendance to the out-patient clinic. The researchers followed the patients at home by telephone and what's app website

Control group

The control group (43) had received the routine hospital care, and at the end of study the researchers providing them the same training that was given to the study group.

Components of the physical exercises

The Rehabilitation Program: respiratory training practices developed by the investigators after revising related literature reviews that include:

Walking exercise with or without assistive devices, accumulated in bouts of ten minutes each to attain the daily goal of thirty minutes

Breathing training consisted of breathing techniques (pursued-lipped, diaphragmatic breathing, deep breathing and incentive spirometer). Intensity and duration of pulmonary rehabilitation were gradually increased to build tolerance and confidence with the goal of reaching maximum tolerated work load during each exercise period. The participants repeated the previously mentioned exercises 3 times every day (4 to 6 minutes each time) and take a rest for 1 minute after each time.

Physical exercise: the participants were asked to perform 20 - 30 minutes of resistance exercises. started by 5 minutes of warm up and finished with 5 minutes off cool down in the form of range of motion exercises (ROM) on both upper and lower body parts to maintain normal cardiac levels and avoid sudden drop in the blood pressure.

Evaluation Phase

The researchers evaluates the participants, at the ICU discharge time, after 2 weeks of intervention, and lastly after 8 weeks of the intervention using the four parts of tool two at each time.

Statistical analysis: The statistical software for social sciences (SPSS) version 22 was used to arrange, classify, and analyze the collected data. For qualitative and quantitative variables, respectively, the mean and standard deviations of the data were reported using descriptive statistics. The t-test, chi-square test, and correlation r-test were the statistical tests that were applied. When the p-value was less than 0.05, strong significance was assumed, and no statistical significance difference was taken into account when the p-value was greater than 0.05.

Results

Table (1): Distribution of Both Study and Control Groups Regarding to Their Bio-demographic Characteristics (n=86)

	Study (n=43)		Control (n=43)		X^2	P-value
	No.	%	No.	%		
Age						
60 : < 65 years	24	55.8	28	65.1	0.964	0.805
65 : < 70 years	17	39.5	13	30.2		
≥ 70 years	2	4.7	2	4.7		
Mean ± SD	64.2 ± 3.74		62.9 ± 3.59		t=1.70	0.092
Gender						
Male	27	62.8	24	55.8	0.434	0.510
Female	16	37.2	19	44.2		
Education						
Illiterate	16	37.2	15	34.8	1.63	0.803
Read and write	9	20.9	6	14		
Basic	6	14	10	23.3		
Diploma	8	18.6	8	18.6		
University	4	9.3	4	9.3		
Occupation						
Employed	20	46.5	22	51.2	0.186	0.666
Not employed	23	53.5	21	48.8		
Presence of chronic diseases						
Hypertension	22	51.1	21	48.9	0.807	0.848
Diabetes	10	23.3	13	30.2		
Cardiac	2	4.7	1	2.3		
Hypertension & diabetes	9	20.9	8	18.6		
Smoking						
- Smoker	29	67.4	30	69.8	0.054	0.816
- None smoker	14	32.6	13	30.2		
BMI						
- 18.5-24.9 "normal weight"	20	46.5	23	53.5	0.440	0.802
- 25-29.9 "moderate obesity"	21	48.8	18	41.8		
- > 30 "morbid obesity"	2	4.7	2	4.7		
Mean ± SD	24.3 ± 1.57		24.6 ± 1.30		t=1.04	0.300

* Statistical significant difference (P ≤ 0.05) ** highly Statistical significant difference (P ≤ 0.01)

Table 1: shows distribution of study and control group regarding bio-demographic characteristics, in relation to age it was found that 55.8 % & 65.1 % of study and control group respectively were between ٦٠ to 6٥ years. In relation to sex 62.8 % & 55.8 % of both groups were males. On the other hand it was observed that 37.2 % & 34.9 % of both groups were illiterate. Regarding to presence of chronic disease it was observed that 51.2 % & 48.8 % had hypertension in both groups. Lastly, 67.4 & 69.8 % of study and control group were smokes respectively.

Table (2): Mean Score of Study and Control Groups Regarding to Their 6 Walk Distance Test Parameters Pre and Post Implementing the Rehabilitation Exercise Protocol (n=86)

	Study (n=43)	Control (n=43)	*t test (P* – value)
	Mean ± SD	Mean ± SD	
Total Distance Walked			
Baseline	144.1 ± 26.9	143.1 ± 36.4	0.0151 (0.880)
ICU Discharge	148.6 ± 46.4	128.2 ± 38.1	2.20 (0.029*)
After 2 Weeks	163.4 ± 37.1	147.2 ± 30.9	2.19 (0.031*)
After 8 Weeks	194.4 ± 21.9	158.9 ± 28.6	6.44 (0.001**)
O2			
Baseline	95 ± 0.816	94.7 ± 0.978	1.31 (0.192)
ICU Discharge	95.1 ± 0.816	94.7 ± 0.978	1.34 (0.184)
After 2 Weeks	95.1 ± 0.827	94.3 ± 1.95	2.36 (0.02*)
After 8 Weeks	94.8 ± 0.852	94.1 ± 2.02	2.29 (0.02*)
HR			
Baseline	85.9 ± 4.50	87.1 ± 6.22	1.02 (0.308)
ICU Discharge	85.5 ± 4.19	81.7 ± 3.49	4.46 (0.001**)
After 2 Weeks	85.5 ± 4.19	81.8 ± 4.00	4.07 (0.001**)
After 8 Weeks	85.3 ± 4.09	81.7 ± 3.68	4.21 (0.001**)

* Statistical significant difference (P ≤ 0.05) ** highly Statistical significant difference (P ≤ 0.01)

Table 2: shows the distribution of study and control groups regarding to the 6 minutes' walk test parameters. Regarding to the base line, the mean of distance walked was 144.1 ± 26.9 & 143.1 ± 36.4 for study and control group respectively and there were no statistical significance difference between them. But after application of the exercise rehabilitation protocol it was observed that at the time of ICU discharge the distance waked increased among the study groups 148.6 ± 46.4 but decreased in the control group 128.2 ± 38.1 and there were statistical significance difference between the two groups. But after 8 weeks of the application of the exercise rehabilitation protocol the study group shows significance increase in the distance walked to be 194.4 ± 21.9 versus 158.9 ± 28.6 for the control group

Concerning to oxygen saturation, no statistical significance difference was found between study and control group at baseline evaluation. At the ICU discharge the study groups' O2 % was 95.1 ± 0.816 but the control group was 94.7 ± 0.978. After 8 weeks there were significance improvement among the study group 94.8 ± 0.852 than the control group 94.1 ± 2.02 with P value 0.02*.

The mean heart rate and standard deviation at the time of ICU discharge was 85.5 ± 4.19 among the study group but the control group 81.7 ± 3.49 with statistical significance difference between them 0.001**. After 8 Weeks the HR was 85.3 ± 4.09 among the study group but the control group 81.7 ± 3.68 with P value 0.001**.

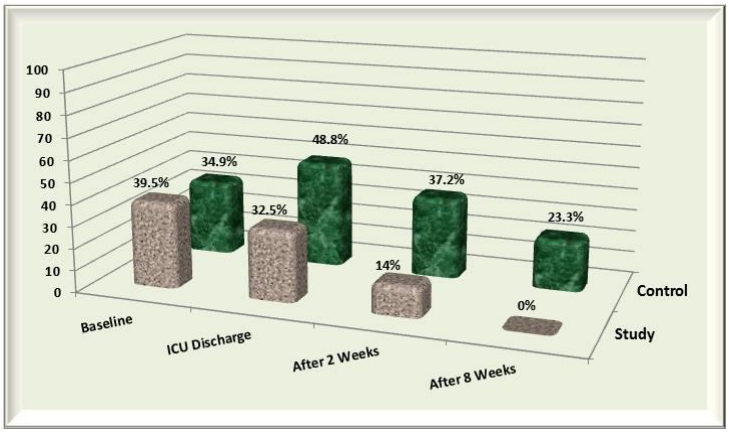

Figure (1): Comparison between Study and Control Group According to Presence of Pre and Post Implementing the Rehabilitation Exercise Protocol (n=86)

Figure 1: shows the distribution of study and control groups regarding presence of dyspnea, it was observed that 39.5 % & 34. 9 % of both groups had dyspnea at base line evaluation. After 8 weeks of implementing the exercise rehabilitation protocol 0 % of the study group had dyspnea and 23.3 % of the control group had dyspnea in the same time

Table (3): Distribution of Both Study and Control Groups Regarding to KATZ Index Scale of Activity of Daily Living Pre and Post Implementing the Rehabilitation Exercise Protocol (n=86)

KATZ Index Scale	Study (n=43)		Control (n=43)		X^2	P-value
	No.	%	No.	%		
Baseline						
- Full function	0	0	0	0	0.212	0.645
- Moderate impairment	41	95.3	40	93		
- Severe impairment	2	4.7	3	7		
ICU Discharge						

KATZ Index Scale	Study (n=43)		Control (n=43)		X^2	P-value
	No.	%	No.	%		
- Full function	0	0	0	0	1.04	0.306
- Moderate impairment	41	95.3	40	93		
- Severe impairment	2	4.7	3	7		
After 2 Weeks						
- Full function	15	34.9	5	11.6	6.62	0.036*
- Moderate impairment	26	60.4	31	72.1		
- Severe impairment	2	4.7	7	16.3		
After 8 Weeks						
- Full function	16	37.2	4	9.3	14.6	0.001**
- Moderate impairment	25	58.1	32	74.4		
- Severe impairment	2	4.7	7	16.3		

* Statistical significant difference (P ≤ 0.05) ** highly Statistical significant difference (P ≤ 0.01)

Table 3: distribution of study and control groups regarding to katz index scale of activity of daily living, it was observed a none statistical significance difference between the two groups before implementing the exercise rehabilitation protocol and at ICU discharge while a statistical significance difference between them was observed after implementing the exercise rehabilitation protocol 2 weeks and after 8 weeks of the study.

Table (4): Distribution of Both Study and Control Groups Regarding Oxford Scale for Measuring Muscle Strength Pre and Post Implementing the Rehabilitation Exercise Protocol (n=86)

	Baseline		ICU Discharge		After 2 Weeks		After 8 Weeks	
	Study (n=43)	Control (n=43)	Study (n=43)	Control (n=43)	Study (n=43)	Control (n=43)	Study (n=43)	Control (n=43)
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
- No detectable muscle contraction	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
- Detectable contraction but no movement achieved	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
- Limb movement achieved, but unable to move against gravity	13 (30.2)	17 (39.5)	13 (30.2)	19 (44.2)	4 (9.3)	9 (20.9)	0 (0)	4 (9.3)
- Limb movement against resistance of gravity	30 (69.8)	26 (60.5)	30 (69.8)	24 (55.8)	30 (69.8)	34 (79.1)	33 (76.7)	34 (79.1)
- Limb movement against gravity and external resistance	0 (0)	0 (0)	0 (0)	0 (0)	9 (20.9)	0 (0)	10 (23.3)	5 (11.6)
- Normal strength	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
X^2 (P value)	0.819 (0.365)		1.79 (0.181)		11.1 (0.004**)		5.68 (0.048*)	

* Statistical significant difference (P ≤ 0.05) ** highly Statistical significant difference (P ≤ 0.01)

Table 4: shows the distribution of study and control groups regarding oxford scale for measuring muscle strength, there were no statistical significance difference between the two groups of the study at the baseline time and at the ICU discharge with P value = 0.365 & 0.181 respectively. But after 2 weeks and 8 weeks of implementing the exercise rehabilitation protocol there were statistical significance difference presented by P value = 0.004** & 0.048* respectively.

Table (5): Correlation between Activity of Daily Living, Total Distance Walked, Heart Rate, Oxygen Saturation and Muscle Strength among Both Study and Control Groups Pre and Post Implementing the Rehabilitation Exercise Protocol (n=86)

Variables	Muscle strength							
	Baseline				After 8 Weeks			
	Study (n=43)		Control (n=43)		Study (n=43)		Control (n=43)	
	r	*p*	*r*	*p*	*r*	*P*	*r*	*p*
- Katz	0.145	0.352	0.221	0.154	0.357	0.019*	0.298	0.052
- HR	- 0.115	0.461	0.176	0.259	0.447	0.003**	0.214	0.168
- O_2	0.118	0.451	0.046	0.771	0.431	0.004**	0.220	0.156
- SMWD	0.166	0.287	0.251	0.105	0.311	0.043*	0.087	0.579

* Statistical significant difference (P ≤ 0.05) ** highly Statistical significant difference (P ≤ 0.01)

Table 5: presents correlation between total score of activity of daily living, total distance walked, heart rate, oxygen saturation and muscle strength among both groups. There were positive correlations before implementing the exercise rehabilitation protocol with no statistical significance difference between them in all the items. But after 8 weeks there were positive correlation with statistical significance difference at the study group only P value = 0.019*, 0.003**, 0.004** & 0.043*, while the control group had positive correlation with no statistical significance difference.

Discussion

The broad group of lung injuries known as interstitial lung disease (ILD) affects the parenchyma of the lung tissue and manifests as a variety of fibrotic and inflammatory patterns. Acute exacerbation (AE-ILD), a sudden worsening of ILD, can happen at any point during the illness. This decline results in abrupt, severe respiratory failure with low oxygen levels, which can need admission to the intensive care unit (ICU) and pose significant health risks including mortality. Krishnan, et al. (2023)

More recent research has examined the importance of evaluating exercise capacity in older ILD patients due to a correlation with improved survival. According to the most recent recommendations, people with ILD have difficulties when it comes to exercising, combining elements that lead to functional restriction Luu et al. (2023), as well as the progression of the illness and participation in a pulmonary rehabilitation (PR) program. The goal of the current study was to assess how an exercise rehabilitation program affected the physical abilities of senior citizens with worsened interstitial lung disease.

According to our study, the majority of the elderly patients in the study sample were male smokers, with mean ages of 64.2 and 62.9 for the study and control groups, respectively which demonstrate that ILD was most likely to affect elderly people. Shen et al. (2021), who reported that the study and control groups' mean ages were 65.3 and 64.9, respectively, which validated the current investigation.

Moreover, Cilli et al. (2023) demonstrated that interstitial lung fibrosis risk rose with age and that IDL was prevalent in individuals 60 years of age and older. Age and male sex, along with a history of tobacco use, were identified by Ng et al. (2022) as risk factors for ILD. This condition is characterized by a gradual onset of cough and/or exertion dyspnea, bibasilar inspiratory crackles, and radiologic evidence of fibrosis, primarily in the lower lobes, with no apparent cause.

Roughly half of the study and control groups had hypertension, about quarter had diabetes mellitus, a smaller percentage had heart disease, and fewer than a quarter had both hypertension and diabetes mellitus, according to the current study. These findings are consistent with those of Essam et al. (2022), who found that approximately 25% of the intervention and control groups had diabetes mellitus and less than 25% had both diabetes and hypertension.

When comparing the mean score of the total distance walked during the 6MWDT at the time of ICU discharge to the baseline and also eight weeks after ICU discharge, elderly patients with ILD who received exercise protocol demonstrate a substantial increase. Due to its beneficial impact on their level of activity, the current findings support the inclusion of physical exercise rehabilitation programs in the management protocols of older patients with ILD.

VThe study's results were consistent with those of ElKomy et al. (2019), who found that the rehabilitation protocol for older patients with ILD resulted in a statistically significant improvement in 6MWD. They also explain why physical rehabilitation programs should be advised as a common, accessible, affordable, and secure treatment for ILD patients, regardless of the cause.

Additionally, Ferté et al. (2022) reported that patients with COPD responding to the same medication showed a substantial improvement in quadriceps muscle strength as well as walking capacity and performance as determined by the 6MWT.

The current study found that following the rehabilitation treatment, the degree of dyspnea improved. Dyspnea was present in both study groups at the baseline evaluation prior to the rehabilitation regimen. However, following the study procedure, it was shown that the intervention group experienced less dyspnea than the control group at the time of ICU discharge, two weeks later, and eight weeks later

The results were corroborated by Ahmed et al. (2022), who discovered that, in comparison to the control group, dyspnea was much lower in ILD patients following pulmonary rehabilitation, even in those with mild to moderate/severe symptoms. After comparing the baseline data findings of the MMRCs, Barata et al. (2022) showed that physical rehabilitation for patients with ILD is helpful in lowering the patients' level of dyspnea. Additionally, Holland et al. (2021) noted that pulmonary rehabilitation usually enhances respiratory functions, decreases dyspnea, and increases exercise capacity.

At baseline, there was no statistically significant difference in the two groups' activity of daily living; however, following the exercise rehabilitation regimen, there was an improvement in this activity after two weeks and eight weeks of ICU discharge. Vinan-Vega et al. (2021) concurred with the aforementioned data, demonstrating that PR enhances exercise capacity and health-related quality of life through its effects on cardiac and peripheral muscle function following patient education and behavioral changes that can lower readmission rates and increase survival. Additionally, exercise training increased the physical activity level and quality of life of individuals with ILD, according to Li et al. (2021).

At baseline, there was no statistically significant difference in muscular strength between the two study groups; however, following the exercise rehabilitation regimen, there was an improvement in muscle strength after two weeks and eight weeks of ICU discharge. These findings support the notion that one of the primary symptoms of ILDS is skeletal muscle dysfunction. A physical exercise rehabilitation program improves patient outcomes and strengthens the cardiopulmonary breathing muscles.

According to Hockele et al. (2022), a pulmonary rehabilitation program improved the functional ability, lung function, and respiratory muscle strength of individuals with post-ILDs. This study supported their findings. According to Grandio et al. (2023), who shared the same idea as this study, limb muscles' force improves after eight weeks of pulmonary rehabilitation, with the change taking place within the first four weeks.

Additionally, PR is suggested to increase fitness before lung transplantation and improves exercise tolerance and quality of life in individuals with pulmonary hypertension, interstitial lung disease (ILD), and chronic lung disease. According to Tsui et al. (2023), chest wall mobilization is expected to improve thoracic extension and rotation, which raises lower thoracic excursion, in patients with ILD undergoing rehabilitation.

Patients with severe ILD benefit from increased respiratory muscle strength as a result of this notable improvement in chest expansion capacity, which enables respiratory muscles to operate at their ideal functional length. Following the implementation of the rehabilitation protocol, the current study demonstrated a positive correlation between the evaluation parameters of ILD. Following eight weeks of ICU discharge, there was a statistically significant difference

between the two groups' heart rates, oxygen saturation, muscle strength, total distance walked, and activities of daily living.

In agreement with the current study, Ichiba et al. (2023) demonstrated a strong link between low 6MWD and high mortality as well as a moderate to strong correlation between 6MWD and physical activity.

The same results as the current study were also noted by Ichiba et al. in 2023, who found that PR dramatically increased 6MWD, expiration, and maximal inspiration. Additionally, Voorn et al. (2023) found that RP significantly improves health-related quality of life (QOL) in patients with ILD by lowering their degree of fatigue and dyspnea. Amin et al. (2022) provide evidence that exercise training and pulmonary rehabilitation (PR) programs enhance functional ability and symptoms in individuals with ILD. After an 8-week PR program, the authors found improvements in peripheral muscle strength, fatigue and dyspnea scores, quality of life, depression, exercise endurance, and the distance walked on the 6-min walk test (6MWT).

Conclusion

Based on the results of the current study, it could be concluded that pulmonary rehabilitation is safe, effective, easy to perform, cheap, and suitable for patients with ILD.

Recommendations

A program of exercise training is recommended as a mandatory component of pulmonary rehabilitation for patients with ILD

Replication of the study on a great probability sample in different geographical areas in Egypt to formulate the main aspects of these problems and for generalizing the findings

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