



FUNCTIONALITY BEFORE AND AFTER PHYSIOTHERAPY IN POST-COVID-19 PATIENTS

FUNCIONALIDAD ANTES Y DESPUÉS DE FISIOTERAPIA EN PACIENTES POST COVID-19

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ABSTRACT

Introduction: COVID-19 is a disease that since its emergence in 2019 has represented a challenge for healthcare services. The sequelae result from impaired quality of life, fatigue, dyspnea and joint pain. **Objective:** To compare physical, respiratory, cognitive and functional independence functional parameters in post-COVID-19 patients with respiratory sequelae before and after a respiratory physical and occupational therapy program. **Methods:** A comparative, quasi-experimental, prospective study was conducted in outpatients discharged from hospitalization for COVID-19 in a 3rd level of care Hospital of the Mexican Institute of Social Security in Puebla, Mexico during 2020-2021. Scales were applied before and after the rehabilitation program. Analytical statistics were used. **Results:** We included 116 patients, 57.7% men, mean age 47.32 years (min. 20, max. 79); 77 (66.3%) patients presented moderate symptoms in hospitalization. A significant p-value was obtained ($p < 0.001$). **Conclusion:** Significant improvement is observed in post-COVID-19 patients after receiving respiratory physical and occupational therapy.

Keywords: SARS-CoV-2; Occupational Therapy; Physical Therapy Modalities. (Source: MESH-NLM)

RESUMEN

Introducción: El COVID-19 es una enfermedad que desde su aparición en 2019 ha representado un reto para los servicios sanitarios. Las secuelas son consecuencia de un deterioro de la calidad de vida, fatiga, disnea y dolor articular. **Objetivo:** Comparar parámetros funcionales físicos, respiratorios, cognitivos y de independencia funcional en pacientes post COVID-19, con secuelas respiratorias antes y después de un programa de terapia física y ocupacional respiratoria. **Métodos:** Se realizó un estudio comparativo, cuasiexperimental, prospectivo en pacientes ambulatorios egresados de hospitalización por COVID-19 en un Hospital de 3er nivel de atención del Instituto Mexicano del Seguro Social en Puebla, México durante 2020-2021. Se aplicaron escalas antes y después del programa de rehabilitación. Se utilizó estadística analítica. **Resultados:** Se incluyeron 116 pacientes, 57,7% hombres, edad media de 47,32 años (min. 20, máx. 79); 77 (66,3%) pacientes presentaron síntomas moderados en hospitalización. Se obtuvo un valor de p significativa ($p < 0,001$). **Conclusión:** Se observa una mejoría significativa en los pacientes post COVID-19 tras recibir terapia física y ocupacional respiratoria.

Palabras clave: SARS-CoV-2; Terapia ocupacional; Modalidades de Terapia Física. (Fuente: DeCS- BIREME)

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INTRODUCTION

The global pandemic of COVID-19 in 2020 originated by the SARS-CoV virus affected considerably the different health and medical care systems, it is estimated that this respiratory disease until August 2023 has affected a total number of 770 085 713 patients, including 6 956 173 reported deaths and an incidence of new cases per week of 9 787 worldwide⁽¹⁾.

COVID-19 infection represents a multisystemic disease, with a broad spectrum of acute, subacute, and long-term manifestations⁽²⁾. Symptoms of acute infection with this pathogen include cough, fever, fatigue, pneumonia, and dyspnea⁽³⁾. Severe symptoms can lead to acute respiratory distress syndrome (ARDS) with urgent need for invasive ventilation⁽⁴⁾. These patients are susceptible to a wide variety of post-infectious complications such as post-intubation dysphagia, muscle weakness, general physical unfitness, myopathy, neuropathy and musculoskeletal dysfunction⁽⁵⁾. These long-term complications significantly diminish the patient's quality of life, with outstanding repercussions on general and emotional health⁽⁶⁾.

Post-acute COVID-19 syndrome presents with persistence of symptoms and late complications over a period of more than four weeks from the onset of symptoms; it is estimated that more than one third of patients develop this syndrome post-infection. The main symptoms include fatigue (35-63%), pain (5-27%), dyspnea (11-43%) and chest pain (5-22%)⁽⁷⁾. According to the World Health Organization (WHO), from July 31 to August 27, 2023, more than 1.4 million COVID-19 cases were reported worldwide, with 1800 deaths. This represents 38% more cases and 50% fewer deaths than the previous 28 days⁽⁸⁾. As of August 2023, 7 649 199 cases have been confirmed in Mexico, 334 472 deaths, with a cumulative case incidence of 5 828.8 per 100 000 population, with 53.7% women and a median age of 38 years⁽⁹⁾.

The management of this pathology requires the multidisciplinary participation of the entire health care team, especially rehabilitation and post-acute care⁽¹⁰⁾. The aim was to reduce symptoms, improve exercise tolerance and quality of life⁽¹¹⁾.

However, in hospitals there is low implementation and little specific dedication^(12,13). So far, studies documenting the results of comprehensive physical and occupational respiratory rehabilitation in patients with post-COVID-19 sequelae in the Latin American population are scarce^(14,15). This paper proposes a physical, pulmonary, cognitive and functional performance reconditioning program to reincorporate these patients to their daily and occupational life.

The objective of this study was to demonstrate the physical, respiratory and functional effects of a post COVID-19 physical and occupational therapy program in patients at a 3rd level hospital.

METHODS

Design and study area

A comparative, quasi-experimental, prospective study was conducted in outpatients discharged from hospitalization for COVID-19 treated at a 3rd level hospital of the Mexican Social Security Institute in Puebla, Mexico, during 2020-2021.

Population and sample

Patients with physical, respiratory or functional independence sequelae were included.

Variables and instruments

Age and gender were recorded, and the following scales were applied before and after the rehabilitation program:

1. Medical Research Council (MRC) scale. It evaluates the strength of three muscle groups in the 4 extremities. Each muscle group scores between 0 (no visible contraction) and 5 (active movement against total resistance). The total sum records values between 0 (total paralysis) and 60 (normal muscle strength). A value below 48 is considered acquired weakness. The functions evaluated are: wrist extension, elbow flexion and shoulder abduction (in thoracic limbs), and hip flexion, knee extension and ankle dorsiflexion (in pelvic limbs). Three attempts can be performed for each muscle group^(13,14).
2. Barthel Index (Barthel). It rates neuromuscular and musculoskeletal processes for dependent or independent performance of activities.



A rating is assigned according to the time spent and the need for assistance, with a final score from 0 (maximum dependence) to 100 (maximum independence). The results can be: independent: 100 points (95 in wheelchair), mild dependent: 91-99, moderate dependent: 61-90, severe dependent: 21-60, or total dependent: 0-20^(15,16).

3. Modified Borg Scale (Borg). It evaluates the individual's subjective perception of exercise exertion. Values range from 0 (total rest) to 10 (maximum effort)⁽¹⁷⁾.

4. 6-minute walk test (6WT). It evaluates functional capacity and the distance covered in meters during 6 minutes. It is performed in patients with moderate or severe exercise limitation of respiratory or cardiac etiology. It is considered to have a good prognosis for life if the distance covered is greater than 350 meters⁽¹⁷⁾.

5. The Lowenstein Occupational Therapy Cognitive Assessment Battery 1st edition (LOTCA). It is an instrument for cognitive assessment in patients with neurological disorders. It consists of five domains: orientation, perception, visual-motor organization, rational operations, categorization, and attention and concentration. It is scored from 1 to 4 according to the patient's capacity and maintenance of attention⁽¹⁸⁾.

6. Dynamometer. It measures the prehensile strength of the hands, according to gender, age and weight. The normal value in women aged 20 to 69 years in dominant hand is 20.2-26.3 kg and non-dominant is 20.9-24.4 kg, and in men aged 20 to 69 years in dominant hand is 30.6-40.3 kg and non-dominant: 27.6-39.6 kg. Three attempts were made with dominant and non-dominant hands, with a 20-second rest between each measurement⁽¹⁹⁾.

Procedure.

The patients recruited underwent the Respiratory Physical and Occupational Rehabilitation Program, which consists of a series of exercises: 1) From resting position, 2) Specific respiratory exercises, 3) Occupational therapy routine, 4) Exercises from seated position, 5) From kneeling posture, 6) From dorsal

decubitus posture, 7) From standing posture, 8) Warm-up and mobility, 9) From bipedal posture, 10) Stretching exercises, 11) Strengthening with rubber bands, 12) Strengthening with medicine ball, 13) Strengthening with dumbbells, 14) Strengthening with leggings, 15) Physical conditioning, 16) Exercises with balloon and hoop, 17) Tandem walk, 18) Static and dynamic balance.

The different exercises applied in this physical and occupational rehabilitation protocol are described in detail in the annex to this document.

Statistical analysis

Analytical statistics were performed. The Kolmogorov-Smirnov test was used to verify the normality of the data distribution. For comparison of parametric quantitative variables, Student's t test for related samples was used. For related nonparametric and ordinal qualitative variables, the Wilcoxon test was used. A $p \leq 0.05$ was considered significant.

Ethical aspects

The present study was approved by the Local Health Research Committee No. 2101 of the Mexican Social Security Institute. All patients signed a letter of informed consent. All information was handled with strict confidentiality and was used exclusively for research purposes. No conflicts of interest were reported.

RESULTS

A total of 133 patients were recruited, of whom 116 successfully completed treatment and 17 did not (13 patients dropped out or lost continuity of treatment and 4 patients due to comorbidities (depression, cancer and uncontrolled systemic arterial hypertension), 67 (57.7%) men and 49 (42.2%) women. The mean age was 47.32 years, minimum age 20 years and maximum age 79 years. Twenty-four (20.6%) patients had mild manifestations in confinement, 77 (66.3%) patients had moderate symptoms in hospitalization and 15 (12.9%) patients required assisted mechanical ventilation (Table 1).

Table 1. Clinical variables of post-COVID-19 patients.

N=116 Gender					
Female 42.2%			Male 57.7%		
Age (years)					
20-29	30-39	40-49	50-59	60-69	70-79
3.4%	16.3%	34.4%	37.9%	6%	1.7%
Severity of illness					
Mild		Moderate		Severo	
20.6%		66.3%		12.9%	

The averages and medians of the scales applied are shown in Table 2. In the MRC scale, an initial median of 48 points was obtained, indicating weakness acquired in intensive care, and a final median of 57, indicating

progress in terms of upper and lower limb mobility and strength. The Barthel index showed an initial mean of 95 with mild dependence and a final mean of 98 (Table 2).

Table 2. Analysis of the initial and final statistics of the scales applied in patients with post-COVID-19.

Scala	Application	Media	Median	Standard Dev	Min.	Max.	Range
MRC	Initial	46.44	48.00	± 6.92	24.00	59.00	35.00
	Final	55.67	57.00	± 4.95	36.00	60.00	24.00
Barthel	Initial	0.95	1.00	± .1033	0.44	0.66	0.56
	Final	0.98	1.00	± .0460	1.00	1.00	0.34
Modified Borg	Initial	5.50	5.00	± 1.79	0.00	9.00	9.00
	Final	1.59	1.00	± 1.41	0.00	5.00	5.00
6WT	Initial	334.50	300.32	± 146.92	17.00	585.00	568.00
	Final	433.50	414.99	± 109.96	34.00	684.00	650.00
LOTCA	Initial	84.00	84.00	± .00	84.00	84.00	0.00
	Final	84.00	84.00	± .00	84.00	84.00	0.00
Left dynamometer	Initial	20.98	20.25	± 10.72	2.50	42.60	40.10
	Final	26.957	26.10	± 13.01	1.70	92.00	90.30
Right dynamometer	Initial	21.41	20.03	± 10.71	2.00	45.70	43.50
	Final	27.06	27.05	± 12.21	1.50	52.60	51.10

All differences recorded $p=0.001$. Abbreviations: MRC: Medical Research Council, 6WT: 6-minute walk test, LOTCA: Lowenstein Occupational Therapy Cognitive Assessment. * Non-normal distribution ((Kolmogórov-Smirnov $p<0.05$).

** Normal distribution (Kolmogórov-Smirnov $p> 0.05$).

In the modified Borg scale we obtained an initial median of 5.00 (strong effort) and a final median of 1.00 (little effort) Table 2. The 6-minute walk test (6WT) considers it ideal for patients to walk over 350 meters. During this test, an initial mean of 334.50 meters was obtained and a final mean after treatment of 433.5

meters (Table 2). In the LOTCA battery all patients scored 84 points before and after treatment (Table 2).

Manual strength was measured with a dynamometer in the right and left hand at the beginning and end of the treatment.



The results were measured in kilograms (kg). In the left hand an initial mean of 20.98 kg and a final mean of 26.95 kg was obtained and in the right hand an initial mean of 21.41 kg and a final mean of 27.06 kg was obtained (Table 2). The variable that showed normal distribution was muscle strength, both in the left and right limbs. The difference in means was significant by Student's t-test with a p value <0.001. The other tests also proved to be highly significant by Wilcoxon test with a value of p <0.001.

DISCUSSION

Coronavirus disease caused by SARS-CoV2 is the cause of ARDS^{20,21}. This disease also presents with symptoms such as palpitations, dyspnea at rest or on exertion, and chest pain following infection⁽²²⁾. Benefits of pulmonary rehabilitation are observed in post COVID-19 patients, in which independence, balance and agility improve significantly, favoring the reintegration of functionality and autonomy⁽¹⁷⁾. This study coincides with what has been reported; 46.4 points are observed on the MCR scale at the beginning and 55.7 points at the end, indicating an improvement in the mobility and strength of the upper and lower limbs.

Fatigue and dyspnea remained persistent in post COVID-19 patients affecting mobility and activities of daily living⁽¹⁸⁾, in addition severe acute respiratory syndrome (SARS) was frequently observed⁽¹⁹⁾. This is consistent with what was found in this study, since Borg at baseline patients were at 5, at the beginning of the 6-minute walk test reported 334.5 meters and the dynamometer in the right thoracic limb 21.4 kg and left 20.9 kg. Post COVID-19 patients manifest impaired

diffusing capacity¹⁶ with persistence of symptoms after the acute phase⁽²¹⁾. The percentage reported in this study on the Borg scale reports that at the end of therapy the patient's strength went from 5 to 1 (little effort). The sequelae were compared in hospitalized and non-hospitalized patients during one year and showed dyspnea and fatigue as acute symptoms in hospitalized patients and after one year of cognitive difficulties (memory and concentration)⁽²²⁾. Contrary to the results of this study, when applying the LOTCA test, no cognitive alterations were reported at the beginning or at the end of the evaluation.

Physical therapy interventions use breathing exercises to promote clearance of secretions, increase chest mobility, relaxation, control dyspnea, and increase pulmonary ventilation⁽²³⁾. The 6-minute walk assesses functional exercise capacity in the management of post-critically ill patients⁽²⁴⁾. In this study a before and after assessment was made, where before patients walked approximately 334.5 meters in 6 minutes, upon receiving therapy, patients increased to 433.5 meters. The six-minute walk showed a better outcome in those who had a significant range related to the distance walked^(25,26). A relatively small sample size and the absence of a control group to evaluate the effect of therapeutic intervention are areas of opportunity in the present study. Although the natural history of the disease is to improvement, Physical Medicine and Rehabilitation intervention can shorten the evolution and improve the symptomatology of patients.

CONCLUSION

The results of the study suggest that post COVID-19 patients show significant improvement with physical and occupational respiratory therapy.

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