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Aspects after hospital discharge, the second face of the SARS-CoV-2: a literature review

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Abstract: Coronavirus disease presents as a public health problem. High rates of hospitalization and impairments that lead to disability and impairment of quality of life. A literature review was conducted between April and May 2020, in the searches, the virtual health library was used as a database, which covers the electronic databases: LILACS and MEDLINE; database PEDro and PubMed. The Boolean operator AND was used to association the following descriptors: Coronavirus. Physiotherapy. Rehabilitation. The probable changes in patients with COVID-19 in the post-acute phase included neuromuscular involvements, neuropathies that lead to MV dependence and consequently pulmonary involvement, fatigue, generalized muscle weakness, pain, decreased functionality. The study becomes relevant because it provides literary support on the conditions related to the physical status of patients with COVID-19 in the post-acute phase, since more and more people are being infected, thus, studies have shown that a large part of the population will need rehabilitation.

Keywords: Coronavirus. Physiotherapy. Rehabilitation

1. Introduction

The new coronavirus appeared in Wuhan, China, in late December 2019 (BOGOCH,2020), in February 2020 the World Health Organization (WHO) titled the disease COVID-19 (ZHOU,2020).

As of May 26, 2020, the respiratory syndrome pandemic caused by the new coronavirus (SARS-CoV-2) had reached the mark of 5,404,512 infected worldwide, with 343,514 dead (WHO,2020). In Brazil, according to the Ministry of Health (MS), until May 26, 2020, we had a total of 391,222 infected, 16,324 in the last 24 hours and 24,512 confirmed deaths (BRASIL, 2020).

Coronavirus is a pathogen that especially affects the human respiratory system, which has caused other outbreaks previously, such as severe acute respiratory syndrome (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV) (ROTHAN & BYRAREDDY, 2020). COVID-19 is an RNA virus that has high aptitude for propagation in the human environment. Infection resulting from the virus has pathogenesis linked to chronic diseases, consequently, patients with comorbidities such as Systemic Arterial Hypertension (SAH), Diabetes, Cardiovascular diseases, among others, have a higher mortality rate. The main symptoms reported are fevers, dyspnea, headache (MOTA, 2020).

In addition, there is an affinity of SARS-Cov-2 that binds to the Angiotensin-Converter Enzyme 2 receptor (ECA2) after protein activation by Transmembrane Protease, serine 2 (TMPRSS2), ECA2 is highly released in the heart in cases such as hypertension and heart failure (ASKIN *et al.*,2020). ACE2, active in its AT1 and AT2 receptors, increases the production of inflammatory cytokines such as interleukin 1 and 6 (IL-1 and IL-6) and Tumor Necrosis Factor (TNF), affects cardiac function (ARAÚJO & MORAIS,2020).

In the more severe cases, patients of SARS-Cov-2 are more likely to develop pneumonia with bilateral interstitial infiltrates, which causes serious changes in the ventilation/perfusion ratio and probable shunt, where hypoxemic respiratory failure (BRUGLIERA, 2020). Hypoxia can lead to multiple organ failure, causes a relationship dependent on the severity of the case, there may be a need for the use of oxygen therapy, noninvasive mechanical ventilation (NIV), including the use of Continuous Positive Airway

Pressure (CPAP), if there is no evolution of the condition, admission to the Intensive Care Unit (ICU) and intubation as a consequence of the use of Invasive Mechanical Ventilation (IMV) (KIEKENS, 2020).

The recommendation of the Brazilian Association of Cardiorespiratory Physiotherapy and Physiotherapy in Intensive Care (ASSOBRAFIR), deals with the use of the interface used in NIV, the most indicated patients to use it and the risk of contamination of the health team by the dispersion of aerosols. As well as the use of closed aspiration system, protective ventilatory strategies and the use of the prona position (MARTINEZ,2020).

In addition, it has been observed that the length of stay in the ICU is long, with an average of 3 weeks (KIEKENS,2020). As a consequence, some specific problems arise that include weakness, hypotrophy and severe muscle fatigue, joint stiffness, neurological, respiratory and functional problems that are related to mobility and mortality (PIZARR,2020), consequences that can last for up to two years or more, requiring physical therapy intervention (CERAVOLO *et al.*,2020). In view of the complications related to the long stay in the ICU, the physiotherapist's objective is to improve the sensation of dyspnea, preserve pulmonary functions and provide improvement of dysfunctions and disabilities, positively impact on quality of life (PIZARR,2020).

Studies show overload in health systems due to the pandemic, where it is a global public health problem. However, most studies are focused on the management of critically obese patients within the ICU, such as ventilatory and pharmacological methods. The longer the length of stay in the ICU, the greater the functional losses of the patient, who will need a physiotherapeutic intervention also after hospital discharge. The importance of data that focus on the probable state of health of the patient who is discharged, helps the justification of the study. Therefore, the objective of this study was to analyze studies that indicate the functional loss of patients with COVID-19 and the need for physical therapy intervention, intervention techniques and guidance for rehabilitation services.

2. Methodology

The present study is characterized as a literature review, of a descriptive nature with quali-quantitative characteristic on the complications related to long ICU stay of patients positive for the new coronavirus. In the searches, the following databases were used: La Literatura Latino Americana e do Caribe em Ciências da Saúde (LILACS), Medical Literature Analysis and Retrieval System Online – MEDLINE, Centro Latino Americano e do Caribe de Informação em Ciências da Saúde (BIREME) via biblioteca Virtual em Saúde (VHL), PubMed and Physiotherapy Evidence Database (PEDro).

The search was conducted between April and May 2020. Articles from scientific journals of the year 2020 were selected. The descriptors used in the study, in English and Portuguese, according to the DeCs (Descriptors in Health Sciences) were: Coronavirus, Physiotherapy, Rehabilitation, were combined by using the Boolean operator "AND".

The inclusion criteria established for this study were articles indexed with full text available, documents addressing the theme on management and the changes caused by COVID-19 in patients, available and free; publications in English and Portuguese; published in 2020. Exclusion criteria were: studies without abstracts, a central theme that did not contemplate the objective of the research; articles published in the period prior to 2020; articles with double indexing and theoretical studies or that focused on other themes.

After screening the titles and their abstracts according to the eligibility criteria, the articles considered relevant were selected to be read in full, the articles will be presented in table form, containing the authors, year of publication, titles, objectives and results.

3. Results and Discussion

Based on the inclusion and exclusion criteria, 17 articles were initially located in the databases surveyed (10 PubMed, 7 MEDLINE). After reading the titles and abstracts, 12 of these were excluded: 6 for duplicity, 4 for not contemplating the theme (1 on treatment of cerebellar ataxia during the pandemic, 1 on relief of depressive symptoms, 1 on chiropractic, immune system and COVID-19 and 1 for relating the state of respiratory muscle strength, obesity and the development of ARDS), 2 because they provide recommendations only for the management of the patient in the acute phase, (Figure 1).

The data extracted were: authors, year of publication, title, objective, conclusion (Table 1).

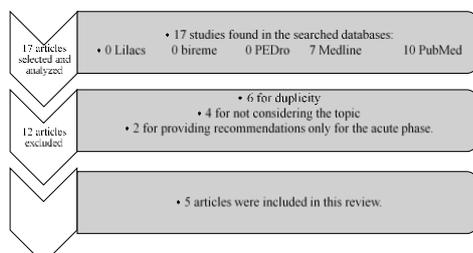


Figure 1. Flowchart of the search result, selection and inclusion of the studies.

Table 1: Search results with the descriptors Coronavirus, Physical therapy, Rehabilitation, describing authors, year of publication, title of the article, objective and conclusion of the study.

Authors	Year	Title	Goal	Conclusion
CERAVOL O et al	2020	Systematic Rapid "living" Review on Rehabilitation Needs due to COVID-19: Update to March 31st 2020.	Present the results of a literature review carried out in documents published from April 1 to April 30, 2020, to provide the rehabilitation community with the latest updates on rehabilitation needs due to the COVID-19 pandemic.	The review showed an increase in evidence of the need for rehabilitation due to COVID-19, including the availability of the first data on the probable high incidence of neurological complications/disabling sequelae in patients hospitalized by COVID-19.
LIU et al	2020	Respiratory Rehabilitation in Elderly Patients With COVID-19: A Randomized Controlled Study.	Investigate efficacy and reveal that six-week respiratory rehabilitation significantly improves respiratory function, QoL, anxiety and depression in elderly patients with COVID-19 and without COPD.	Respiratory rehabilitation of six weeks may improve respiratory function, QoL and anxiety in elderly patients with COVID-19, but does not present significant improvement in the depressive state of the elderly and in activities of daily living.
SHEEHY, L.M	2020	Considerations for Post-acute Rehabilitations for Survivors of COVID-19.	Answering the question "What rehabilitation services do COVID-19 survivors need?"	Rehabilitation after COVID-19 is similar to that provided for many patients in geriatric rehabilitation units who have been affected by diseases or injuries. May present sequelae regarding viral disease and prolonged time on MV. Many will have pre-existing comorbidities.

Legend: COVID-19 = Corona Virus Disease (Coronavirus disease); COPD = Chronic Obstructive Pulmonary Disease; QoL= Quality of Life; VM = Mechanical Ventilation.

The number of studies selected for the present study, five, reflects that research is still ongoing and that research is needed to further investigate and investigate studies that highlight the role of respiratory rehabilitation in the subacute phase of COVID-19 and provide protocols to guide the clinical practice of physical therapists.

Considering the information provided by the articles selected to be part of this study, it was possible to assemble 2 lines of thought.

Probable Changes vs. Need for Rehabilitation

SHEEHY (2020), considered some complications that may affect individuals with COVID-19. Cardiac alterations were present in 20% of the patients in a Chinese study, conducive to comorbidities and develop alterations such as: ARDS (59%), Acute Kidney Injury (9%), electrolyte disorders (16%), hypoproteinemia (13%) and coagulation disorders (6%), with a higher probability of mortality outcome when compared to other patients (51% VS 5%). Changes included arrhythmia, heart failure, decline in ejection fraction, elevation of troponin I, and severe myocarditis with reduced systolic function. However, due to the absence of long-term studies, it is not possible to describe the need for rehabilitation in these patients, but cardiac changes should be taken into account in patients admitted for rehabilitation.

Neurological symptoms such as corticospinal symptoms, confusion and neuromuscular diseases affected more than half of patients with COVID-19. Some complications could occur in infected patients, such as Critical Patient Polyneuropathy (PPC), which leads to axonal degeneration, causes difficulty in weaning from MV, generalized muscle weakness (including the diaphragm), and distal sensory loss. Associated with pain, decreased Range of Motion (ROM), fatigue, incontinence, dysphagia, which can lead to functional and QOL losses that can persist for up to two years or more (CERAVOLO, *et al.* 2020; SHEEHY, 2020).

An Italian study included 170 patients with COVID-19, of which 166 underwent short-physical Performance Battery (SPPB), which is a scale used for functional evaluation. Patients with a mean age of 70 years (59-76) presented moderate/severe impairment of functional capacity, 55% of them had a score of zero in the SPPB, but of these 55%, 41.7% already had deficiency before being affected by COVID-19 (SIMONELLI *et al.*, 2020).

Therefore, rehabilitation in COVID-19 patients aims to improve respiratory symptoms such as dyspnea, relieve symptoms of anxiety and depression, prevent and improve dysfunctions, and improve QoL as much as possible (ZHAO, 2020).

LIU *et al.*, (2020) demonstrated well the need and benefits of rehabilitation. The study included 72 patients from the Huang Gang Central Hospital diagnosed with COVID-19 who had been discharged from the hospital with satisfactory results, with the following inclusion criteria: age ≥ 65 years, no COPD or any other previous respiratory

disease, without heart or neurodegenerative disease, with Forced Expiratory Volume in the First Second (VEF1) $\geq 70\%$.

The patients were evaluated for respiratory function, which analyzed the values of VEF1, Forced Vital Capacity (FVC) and DLCO% (refers to the amount of CO₂ that passes through the alveolo to the capillaries per unit of time) by means of a computerized spirometer, the exercise resistance measured with the 6-minute walk test (6MWT), activities of daily living (ADL) and QOL were analyzed using the Functional Independence Measure (FIM) scale and the SF-36 questionnaire (LIU *et al.*, 2020).

Depression and anxiety were analyzed by the self-assessment depression scale and the self-assessment anxiety scale. The patients were divided into intervention group and control group, which were compared after 6 weeks of rehabilitation, evidencing: statistically significant improvement in FF1, FVC, FVC1/FVC, DLCO%, 6MWT, QOL and anxiety. Depression and activities of daily living showed no statistically significant improvement (LIU *et al.*, 2020).

Guidelines for professionals and establishments

In order to relieve the burden in intensive care hospitals, facilities were used to host patients with COVID-19 in the post-acute phase of the disease, which caused an unexpected change in the dynamics of organization of the units, who received patients discharged from critical care, but were not stable enough to be discharged and return to their homes. Some of the changes were: communication with the patient's family made by video call with tablets exclusive to the COVID ward, delivery of personal objects such as clothing were left at reception and taken to the covid ward by nurses, patients were not allowed to leave the room, to reduce contamination was used Venturi mask for oxygen therapy and viral filter before the expiratory valve in the NIV, only 1 or 2 physiotherapists per shift due to scarcity of Personal Protective Equipment (PPE), monitoring and use of NIV/CPAP and shared oxygen therapy between physiotherapist and nurse, communication was made through cell phone or computer since no role could leave the covid ward, pneumologist was left out of the covid ward guiding professionals via telephone when necessary (SIMONELLI *et al.*, 2020).

SHEEHY (2020), attentive to the fact that some patients considered cured have cases of reinfection from 5 to 13 days after discharge. This is worrisome for patients who go to long-term institutions or rehabilitation services because they may contaminate other patients or residents, additional quarantine of an additional 14 days has been recommended. In addition, it provides some recommendations for rehabilitation services, such as: planning therapeutic activities in order to minimize the number of people involved, group therapies should be suspended, collective use equipment such as TheraBand and dumbbells should be decontaminated among patients, walking practice in a low-used location, rehabilitation teams divided so that one work

independent of the other, so that if most members of one team get sick, it doesn't harm the other.

The most used evaluation methods were:

- Maximal inspiratory pressure and maximum expiratory pressure (MMAX/MEP), 6-minute walk test (6MWT), Cardiopulmonary Exercise Test (CPO), Berg balance scale, Short-physical Performance Battery (SPPB), Borg stress perception index., Forced Expiratory Volume in the First second (VEF1), Medical Research Council scale (MRC) for muscle strength, functional independence measure scale (FIM) and SF-36 questionnaire (LIU *et al.*,2020; SHEEHY,2020; ZHAO *et al.*,2020).

Exclusion criteria for the rehabilitation program were used by ZHAO *et al.*, (2020), baseline heart rate >100bpm, Blood pressure <90/60 mmHg or >140/90mmHg, Peripheral Oxygen Saturation (SpO₂) <95%. Diverging from SIMONELLI *et al.*, (2020), which tolerated saturation levels ≥92%.

In his study, ZHAO *et al.*, (2020), recommended the implementation of an education program for patients, which, among other information included, information on lifestyle and the importance of cardiopulmonary rehabilitation. Regarding the interventions, aerobic exercises were recommended (walking, short walking, slow running and swimming); strength exercises with 8-12 repetitions in 3 sets with 2 minutes interval, 2-3 times a week, for 6 weeks; breathing exercises according to the patient's need (to assess the presence of wheezing, difficulty in sputum, etc.), mobilization of muscle groups, airway clearance, use of positive expiratory pressure and Tai Chi exercises. SHEEHY (2020) included Neuromuscular Electrical Stimulation (NMES) for strength gain and use of ergometer cycle 3-5 times a week, progressively until it reaches 20-30 minutes of duration.

LIU *et al.*, (2020) used a rehabilitation program for 6 weeks, 2 times a week, which consisted of: (1) respiratory muscle training with a positive pressure device at expiration: 3 sets with 10 repetitions each and with parameters set at 60% of the maximum expiratory pressure of the individual, having a rest period of 1 minute between sets; (2) 10 active coughs; (3) 30 voluntary diaphragmatic contractions in the supine position, placing an average weight (1-3Kg) in the anterior abdominal wall; (4) Stretching of respiratory muscles; (5) guidance to perform active coughs and breathing with labial freno at home, 30 repetitions per day.

The limitations of the study refer to the scarcity of published articles focusing on the post-acute phase of patients and the fact that the available studies still provide information based on expert opinions, only one intervention study was found.

4. Conclusions

The probable changes in patients with COVID-19 in the post-acute phase included neuromuscular involvements, neuropathies that lead to MV dependence, fatigue, generalized muscle weakness, pain, and decreased

independence and quality of life; heart disease leads to a higher mortality rate; most patients, especially the elderly, had decreased lung function, exercise resistance, muscle strength, independence and quality of life, some also had symptoms of depression and anxiety.

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