

CHAPTER 22

REHABILITATION IN COVID-19

Tuba Tulay Koca

*(Assoc. Prof. Dr.); Kahramanmaraş Sutcu Imam University, Faculty of Medicine, Department of Physical Medicine and Rehabilitation, e-mail: tubatulaykoca@outlook.com
ORCID ID: 0000-0002-4596-858X*

INTRODUCTION:

The rehabilitation process is focused on helping people suffering from a disorder to maximize functional ability, psychological health, and social cohesion. Rehabilitation is crucial for maximizing recovery for people after acute illness and maintaining function for those with chronic illness. The rehabilitation process starts with the disease and continues in the subsequent recovery period. The goal is to improve the functional level.

The COVID-19 pandemic has led to a massive increase in the need for rehabilitation for the population, both directly and as a result of social isolation, mobility restriction and health system disruption. Although the need for rehabilitation has increased, rehabilitation processes in diseases other than COVID-19 have been interrupted by the pandemic.

COVID-19 patients need rehabilitation in many ways; cardiopulmonary complications, complications due to stay in intensive care, weight loss, loss of muscle mass, neuromuscular complications are the main ones. The rehabilitation protocol is personal and planned according to the needs of the individual. Here, the possible effects of the COVID-19 outbreak from the eyes of a physician were reviewed and the guidelines in the literature on rehabilitation were summarized.

COVID-19 PANDEMIC

Coronavirus is a large family of virus that cause illnesses from the common cold up to more serious diseases such as Severe Acute Respiratory Syndrome (SARS-CoV) and Middle East Respiratory Syndrome (MERS-CoV). In 2019 December, a new coronavirus was identified as the cause of a disease outbreak that originated in China.

The virus is now known as the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) due to COVID-19 infection was first reported on December 31, 2019. In March 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic. A period of 1.5 years has passed since the first emergence of the disease, and it always appears with different pathophysiological pathways and clinical features. Although COVID-19 primarily affects the respiratory system, it also causes serious and fatal disease with multisystem involvement. The long-term effects of COVID-19 are unknown.

COVID-19 CLINIC AND THE ROLE OF REHABILITATION

Current data show that it mainly causes cardiopulmonary complications, decrease in quality of life and emotional stress in most of the patients. It seems that there is a need for guides in determining rehabilitations after COVID-19.

COVID-19 can cause viral pneumonia with pulmonary infiltrates, deep shortness of breath and hypoxia. Hypoxia can be persistent and requires prolonged supplemental oxygen and effort desaturation. In those who are severely ill from COVID-19, a hyperinflammatory condition can cause multiple organ dysfunction, including myocarditis and heart failure. This hyperinflammatory condition combined with inactivity and inadequate food intake are risk factors for acute sarcopenia (loss of muscle mass and strength).

Rehabilitation medicine plays an important role in reducing the disability of COVID-19 survivors and ensuring their optimal functions. Patients hospitalized due to the COVID-19 pandemic may experience symptoms such as fever, muscle pain, fatigue, cough and shortness of breath. Older age groups and those with concomitant illnesses are at risk of developing more serious illness and physical fitness. Rehabilitation have an important role in support-

ing hospitalized patients with COVID-19 but also need to be aware of challenges when treating these patients.

Rehabilitation is necessary both during and after the COVID-19 disease to reduce dysfunction and disability due to the disease. As before the pandemic, it is not easy to reach rehabilitation services. Especially the elderly population with accompanying disease and those with severe disease need more rehabilitation.

Various degrees of disturbances have been reported, particularly in respiratory, physical and psychological functions. Respiratory rehabilitation intervention may improve prognosis, maximize functional preservation and improve quality of life (QoL), but there lacks of studies worldwide exploring the outcome of this intervention. Liu K et al. observed that the 6-week respiratory rehabilitation program caused improvement in respiratory function, quality of life, anxiety and depression in patients with COVID-19. Rehabilitation has certain beneficial effect in the acute stage, and especially in the recovery stage, including improving respiratory function, exercise endurance, self-care in daily living activities, as well as psychological support, etc.

In the field of rehabilitation, necessary guides have begun to be created to address these patients in every period. First of all, these patients should be well defined and their needs should be determined before rehabilitation. These include comorbidities, complications due to hospitalization in intensive care, and the effects of the virus on cardiac, immune, neurological, and cognitive systems.

In addition, rehabilitation programs related to cardiopulmonary, mobility and function should be determined. Providing function, disability and return to daily life with a detailed, individual assessment and progressive treatment plan will positively contribute to the quality of life of the person. Determining the patient's needs quickly and directing them to appropriate rehabilitation programs will contribute to success. In the paper by Kiekens C et al.¹¹ rehabilitation and in particular respiratory management in the acute and immediate post-acute phases are summarized. In the post-acute phase, severe muscle weakness and fatigue, dysphagia, psychological problems, mobility, activities of daily living and impaired functions including work are frequently observed.

After COVID-19, many people experience various problems related to organ functions, and rehabilitation is necessary to maintain normal functions of these people. In addition, a large number of COVID-19 patients have been

deprived of rehabilitation services due to isolation and quarantines. Survivors of severe COVID-19 experience persistent weakness and cardiorespiratory failure. Feasibility and potential benefit of cardiopulmonary rehabilitation after COVID-19 remains unclear. Hermann M. et al.¹³ retrospectively analyzed COVID-19 patients and they found that comprehensive cardiopulmonary rehabilitation after COVID-19 is safe, feasible, and effective. They found improvement in physical performance and general health.

Zha Lu et al.¹⁴ worked on modified rehabilitation exercises for COVID-19 patients. These exercises focused on facilitating the pulmonary function and expectoration process. Additionally, they integrated acupuncture into the exercises. They found that these exercises facilitated breathing and expectoration in mild case.

GUIDES ON COVID-19 REHABILITATION

This includes rehabilitation, safety recommendations, rehabilitation during treatment, discharge recommendations, and staffing & commendations. Rehabilitation includes respiratory support and active mobilization should be planned during the hospitalization period. Respiratory support includes breath control, thoracic expansion exercises, airway clearing techniques and strengthening the respiratory muscles. Active mobilization suggestions include in-bed mobility activities, active range of motion exercises, active extremity exercises, daily living exercises, transfer training, ergometer, gait training and ambulation etc....

Physical Medicine and Rehabilitation experts from eleven different countries in Europe and North America have published guidelines on the clinical experience of the rehabilitation processes of COVID-19 patients. According to this guideline, COVID-19 patients reported particularly 1) Respiratory 2) Cognitive 3) Loss of condition 4) Critical illness neuromyopathy 5) Dysphagia 6) Joint pain and stiffness 7) Severe sequelae and loss of function in psychiatric areas.

The pulmonary rehabilitation principles suggested by Chinese Rehabilitation services are; 1) Pulmonary rehabilitation for hospitalized patients, 2) Pulmonary rehabilitation is not recommended for serious / critically inpatients 3) Training with video or visual instructions for isolated patients 4) Evaluation and observation throughout the entire pulmonary rehabilitation 5) It includes adequate protective equipment.

PULMONER REHABILITATION

Pulmonary rehabilitation is the treatment of chronic respiratory disease, despite standard therapy. Respiratory diseases not only cause primary lung disease but also; includes peripheral muscle dysfunction, respiratory muscle dysfunction, nutritional abnormalities, heart failure, skeletal disease, sensory deficits, psychosocial dysfunction.

Pulmonary rehabilitation can be directly made or indirectly with printed materials, visual training, training videos or remote consultation approach for patients isolated due to COVID-19.

The main goals of pulmonary rehabilitation for the patients with COVID-19 are;

- To reduce dyspnea symptoms,
- Reduce loss of function,
- To prevent / reduce complications that may develop,
- Preserving / improving physical function,
- To reduce anxiety and depression,
- Ultimately to improve the quality of life.

POST-COVID SYNDROME:

We also see long-term post-covid prolonged findings in people who have had the disease. Post-COVID syndrome (known as 'long COVID') is a prevalent syndrome. It includes a plethora of symptoms (exercise intolerance, dyspnea, chest pain, chemosensory impairment, lymphadenopathy, rhinitis, appetite loss, palpitations and orthostatic intolerance) which may last for weeks or more. This condition seem to be related to a virus- or immune-mediated disruption of the autonomic nervous system resulting in orthostatic intolerance syndromes.

In post-covid period some of the patients may have long-term impairment and dysfunctions, including pulmonary fibrosis, heart, liver, kidney, nerve and immune system. It is not yet possible to know how much of post-intensive care syndrome symptoms and respiratory failure will remain in the late post-acute and chronic period. In the literature there are also studies reporting permanent symptoms and findings in patients with post-COVID period.

Therefore, patients with permanent complaints should be included in long-term rehabilitation plans.

WHAT IS TELEREHABILITATION?

Telerehabilitation serves to solve this problem by aiming to provide rehabilitation services for individuals in remote areas. Telerehabilitation systems of this type, which are easily assembled using a combination of low-cost technologies, can be a powerful tool in addressing the social struggle with this pandemic, regardless of their use in the hospital or community.

Telemedicine may also be used to follow-up with patients in the postacute period. Such clinical pathways should each involve dedicated multidisciplinary teams composed of pulmonologists, physiatrists, neurologists, cardiologists, physiotherapists, neuropsychologists, occupational therapists, speech therapists, and nutritionists. The widespread use of telerehabilitation will be beneficial in reaching health services in many areas of medicine.

COVID-19 IN TURKEY

In the first case it was identified as the first COVID-19 patient on 11 March 2020, in Turkey. Considering that the rate of patients developing sequelae associated with COVID-19 will rapidly increase, Physical Medicine and Rehabilitation (PMR) specialists have important duties in reducing disabilities and restoring, optimizing functions in the acute hospital environment. The COVID-19 pandemic affected seriously both the services and the PMR physicians as early as the first month. This effect is expected to become worse, when the duration of pandemic prolongs.

A group of physiatrist in Turkey, Ayür Y et. al.²⁷ declared clinical practice guideline includes pulmonary rehabilitation (PR) recommendations for adult COVID-19 patients which is developed in the light of the guides on the diagnosis and treatment of COVID-19 provided by World Health Organisation (WHO) and Turkish Republic Ministry of Health, and recently published scientific literature, PR recommendations for COVID-19 regarding basic principles of pulmonary rehabilitation.

The organisations make recommendations for the initiation of the rehabilitation protocol for patients who are hemodynamically stable and PCR negative, especially in the acute period.

Because a patient who is not hemodynamically stable can easily enter dyspnea with the effort caused by exercise. We may face undesirable effects due to exercise.

It is also important for the practitioner to protect himself from infection with personal protective equipment. This should be the priority.

COVID-19 RHEUMATIC REHABILITATION

We know that many viruses (HAV, HBV, HCV, parvovirus, CMV, EBV, Influenza etc...) cause poly / oligoarthritis. These types of viral arthritis heal without any sequelae. In the literature, we see that clinical pictures of mono and oligoarthritis have been reported in the acute / subacute period due to COVID-19. These patients should be evaluated within the scope of rheumatic disease rehabilitation. The joint should be immobilized in the acute period, exercise program and joint protective interventions should be planned.

COVID-19 PHYSICAL ACTIVITY, EXERCISE AND IMMUNITY

Physical activity (FA) is an indicator of one of the primary conditions of healthy living and therefore one of the primary components of wellness medicine. Physical exercise has proven beneficial in preventing illness, adjunctive treatment of chronic illnesses, and psychological well-being. Moreover, the protective effect of exercise on the immune system is known and an optimal immune system is very important in the response against COVID-19. Considering the current social isolation recommendations in different countries, it is essential to maintain the routine physically active lifestyle of people as a preventive health measure in these days when the virus spread is tried to be prevented. It is worth remembering that WHO recommends physical activity for at least 150 minutes per week for healthy and asymptomatic adults and 300 minutes per week for children and adolescents. This time of physical activity should accumulate on the days of the week; it can be divided according to individual routine and preferably separately according to routine, and should preferably consist of medium and vigorous intensity activity.

To elaborate the benefits of physical activity by showing the effect of regular physical activity in increasing immune function and reducing the risk of the severity or duration of viral infections with well-supported evidence. The most consistent evidence shows that moderate physical engagement (~ 150 minutes / week) is necessary for optimal immune support.

CONCLUSION

In summary, most of the patients recovering from COVID-19 are of advanced age and have accompanying multisystem problems. In addition, prolonged persistent symptoms and signs after COVID-19 are common. There is a need for rehabilitation services in different areas including cardiopulmonary, physical insufficiency, cognitive dysfunction, musculoskeletal symptoms, chronic pain, social isolation and difficulty in accessing health services.

REFERENCES:

- Lithander FE, Neumann S, Tenison E, Lloyd K, Welsh TJ, Rodrigues JCL, et al. COVID-19 in older people: a rapid clinical review *Age and Ageing* 2020;49(4):501–515. doi: 10.1093/ageing/afaa093.
- Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. China Novel Coronavirus Investigating and Research Team. A Novel Coronavirus from Patients with Pneumonia in China, 2019. *N Engl J Med*. 2020 Feb 20;382(8):727-733. doi: 10.1056/NEJMoa2001017. Epub 2020 Jan 24. PMID: 31978945; PMCID: PMC7092803.
- Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020 Feb 15;395(10223):497-506. doi: 10.1016/S0140-6736(20)30183-5. Epub 2020 Jan 24. Erratum in: *Lancet*. 2020 Jan 30;: PMID: 31986264; PMCID: PMC7159299.
- Ye Q, Wang B, Mao J. The pathogenesis and treatment of the 'cytokine Storm' in COVID-19. *J Infect* 2020. doi: 10.1016/j.jinf.2020.03.037.
- Welch C, K Hassan-smith Z, Greig C, M Lord J, Jackson TA. Acute sarcopenia secondary to hospitalisation - an emerging condition affecting older adults. *Aging Dis* 2018; 9: 151–64.
- De Biase S, Cook L, Skelton DA, Witham M, Ten Hove R. The COVID-19 rehabilitation pandemic. *Age Ageing*. 2020 Aug 24;49(5):696-700. doi: 10.1093/ageing/afaa118. PMID: 32470131; PMCID: PMC7314277.
- Liu K, Zhang W, Yang Y, Zhang J, Li Y, Chen Y. Respiratory rehabilitation in elderly patients with COVID-19: A randomized controlled study. *Complement Ther Clin Pract*. 2020 May;39:101166. doi: 10.1016/j.ctcp.2020.101166. Epub 2020 Apr 1. PMID: 32379637; PMCID: PMC7118596.
- Li J. Rehabilitation management of patients with COVID-19: lessons learned from the first experience in China. *Eur J Phys Rehabil Med*. 2020 Jun;56(3):335-338. doi: 10.23736/S1973-9087.20.06292-9. Epub 2020 Apr 24. PMID: 32329589.

- Sheehy LM. Considerations for Postacute Rehabilitation for Survivors of COVID-19. *JMIR Public Health Surveill.* 2020 May 8;6(2):e19462. doi: 10.2196/19462. PMID: 32369030; PMCID: PMC7212817.
- Thomas P, Baldwin C, Bissett B, Boden I, Gosselink R, Granger CL, et al. Physiotherapy management for COVID-19 in the acute hospital setting: clinical practice recommendations. *Journal of Physiotherapy.* 2020 Mar 30. doi: 10.1016/j.jphys.2020.03.011. <https://www.sciencedirect.com/science/article/pii/S183695532030028X?via%3Dihub>
- Kiekens C, Boldrini P, Andreoli A, Avesani R, Gamna F, Grandi M, et al. Rehabilitation and respiratory management in the acute and early post-acute phase. "Instant paper from the field" on rehabilitation answers to the COVID-19 emergency. *Eur J Phys Rehabil Med.* 2020 Jun;56(3):323-326. doi: 10.23736/S1973-9087.20.06305-4. Epub 2020 Apr 15. PMID: 32293817.
- Wade DT. Rehabilitation after COVID-19: an evidence-based approach. *Clin Med (Lond).* 2020 Jul;20(4):359-365. doi: 10.7861/clinmed.2020-0353. Epub 2020 Jun 9. PMID: 32518105; PMCID: PMC7385804.
- Hermann M, Pekacka-Egli AM, Witassek F, Baumgaertner R, Schoendorf S, Spielmanns M. Feasibility and Efficacy of Cardiopulmonary Rehabilitation After COVID-19. *Am J Phys Med Rehabil.* 2020 Oct;99(10):865-869. doi: 10.1097/PHM.0000000000001549. PMID: 32732746; PMCID: PMC7406212.
- Zha L, Xu X, Wang D, Qiao G, Zhuang W, Huang S. Modified rehabilitation exercises for mild cases of COVID-19. *Ann Palliat Med.* 2020 Sep;9(5):3100-3106. doi: 10.21037/apm-20-753. Epub 2020 Aug 10. PMID: 32787373.
- Felten-Barentsz KM, van Oorsouw R, Klooster E, Koenders N, Driehuis F, Hulzebos EHJ, et al. Recommendations for Hospital-Based Physical Therapists Managing Patients With COVID-19. *Phys Ther.* 2020 Aug 31;100(9):1444-1457. doi: 10.1093/ptj/pzaa114. PMID: 32556323; PMCID: PMC7337861.
- Carda S, Invernizzi M, Bavikatte G, Bensmail D, Bianchi F, Deltombe T, et al. COVID-19 pandemic. What should Physical and Rehabilitation Medicine specialists do? A clinician's perspective. *Eur J Phys Rehabil Med.* 2020 Aug;56(4):515-524. doi: 10.23736/S1973-9087.20.06317-0. Epub 2020 May 19. PMID: 32434314.
- Chinese Association of Rehabilitation Medicine; Respiratory Rehabilitation Committee of Chinese Association of Rehabilitation Medicine; Cardiopulmonary Rehabilitation Group of Chinese Society of Physical Medicine and Rehabilitation. [Recommendations for respiratory rehabilitation of coronavirus disease 2019 in adult]. *Zhonghua Jie He He Hu Xi Za Zhi.* 2020 Apr 12;43(4):308-314. Chinese. doi: 10.3760/cma.j.cn112147-20200228-00206. PMID: 32294814.
- Righetti RF, Onoue MA, Politi FVA, Teixeira DT, Souza PN, Kondo CS, et al. Physiotherapy Care of Patients with Coronavirus Disease 2019 (COVID-19) - A Brazilian Experience. *Clinics (Sao Paulo).* 2020 Jun 22;75:e2017. doi: 10.6061/clinics/2020/e2017. PMID: 32578825; PMCID: PMC7297520.

- Barker-Davies RM, O'Sullivan O, Senaratne KPP, Baker P, Cranley M, Dharm-Datta S, et al. The Stanford Hall consensus statement for post-COVID-19 rehabilitation. *Br J Sports Med.* 2020 Aug;54(16):949-959. doi: 10.1136/bjsports-2020-102596. Epub 2020 May 31. PMID: 32475821; PMCID: PMC7418628.
- Walsh-Messinger J, Manis H, Vrabec A, Sizemore J, Bishof K, Debidda M, et al. The Kids Are Not Alright: A Preliminary Report of Post-COVID Syndrome in University Students. medRxiv [Preprint]. 2020 Nov 29:2020.11.24.20238261. doi: 10.1101/2020.11.24.20238261. PMID: 33269366; PMCID: PMC7709187.
- Dani M, Dirksen A, Taraborrelli P, Torocastro M, Panagopoulos D, Sutton R, et al. Autonomic dysfunction in 'long COVID': rationale, physiology and management strategies. *Clin Med (Lond).* 2021 Jan;21(1):e63-e67. doi: 10.7861/clinmed.2020-0896. Epub 2020 Nov 26. PMID: 33243837.
- Mendelson M, Nel J, Blumberg L, Madhi SA, Dryden M, Stevens W, et al. LongCOVID: An evolving problem with an extensive impact. *S Afr Med J.* 2020 Nov 23;111(1):10-12. doi: 10.7196/SAMJ.2020.v111i1.15433. PMID: 33403997.
- Garg P, Arora U, Kumar A, Wig N. The "post-COVID" syndrome: How deep is the damage?. *J Med Virol.* 2021;93(2):673-674. doi:10.1002/jmv.26465
- Mukaino M, Tatemoto T, Kumazawa N, Tanabe S, Kato M, Saitoh E, et al. Staying active in isolation: Telerehabilitation for individuals with the SARS-CoV-2 infection. *Am J Phys Rehabil Med.* 2020 Apr 8. doi: 10.1097/PHM.0000000000001441
- Iannaccone S, Castellazzi P, Tettamanti A, Houdayer E, Brugliera L, de Blasio F, et al. Role of Rehabilitation Department for Adult Individuals With COVID-19: The Experience of the San Raffaele Hospital of Milan. *Arch Phys Med Rehabil.* 2020 Sep;101(9):1656-1661. doi: 10.1016/j.apmr.2020.05.015. Epub 2020 Jun 4. PMID: 32505489; PMCID: PMC7272153.
- Yağcı İ, Sarıkaya S, Ayhan FF, Bahsi A, Bilir Kaya B, Erhan B, et al. The effects of COVID-19 on Physical Medicine and Rehabilitation in Turkey in the first month of pandemic. *Turk J Phys Med Rehabil.* 2020 Jul 7;66(3):244-251. doi: 10.5606/tftrd.2020.6800. PMID: 33089080; PMCID: PMC7557627.
- Aytür Y, Köseoğlu BF, Taşkıran ÖÖ, Gökkaya NK, Delialioğlu SÜ, Tur BS et al. Pulmonary Rehabilitation Principles After SARS-CoV-2 (COVID-19): A Guideline for the Management of Acute and Subacute Course. *J PMR Sci.* 2020;23(2):111-28.
- Parisi S, Borrelli R, Bianchi S, Fusaro E. Viral arthritis and COVID-19. *Lancet Rheumatol.* 2020 Nov;2(11):e655-e657. doi: 10.1016/S2665-9913(20)30348-9. Epub 2020 Oct 5. PMID: 33043303; PMCID: PMC7535796.
- Berkovic D, Ackerman IN, Briggs AM, Ayton D. Tweets by People With Arthritis During the COVID-19 Pandemic: Content and Sentiment Analysis. *J Med Internet Res.* 2020 Dec 3;22(12):e24550. doi: 10.2196/24550. PMID: 33170802; PMCID: PMC7746504

- Rodríguez MÁ, Crespo I, Olmedillas H. Exercising in times of COVID-19: what do experts recommend doing within four walls? *Rev Esp Cardiol.* 2020 Apr 15. doi: 10.1016/j. recesp.2020.04.002.
- Ferreira MJ1, Irigoyen MC, Consolim-Colombo F, Saraiva JFK, Angelis K. Physically Active Lifestyle as an Approach to Confronting COVID-19. *Arq Bras Cardiol.* 2020 Apr 9. pii: S0066- 782X2020005006201. doi: 10.36660/abc.20200235.
- Laddu DR, Lavie CJ, Phillips SA, Arena R. Physical activity for immunity protection: Inoculating populations with healthy living medicine in preparation for the next pandemic..*Prog Cardiovasc Dis.* 2020 Apr 9. pii: S0033-0620(20)30078-5. doi: 10.1016/ j.pcad.2020.04.006