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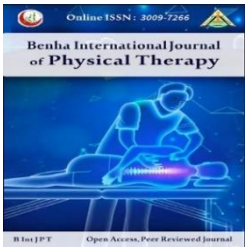

Original research

Musculoskeletal symptoms in COVID-19 and physiotherapy role: Literature review and case study

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Abstract

Background: Human's Coronavirus Disease 2019 (COVID-19) is a pandemic syndrome with many musculoskeletal manifestations besides respiratory, internal, neurological, and psychosocial symptoms. Physiotherapy can have a role in resolving these problems. **Purpose:** to review the literature about musculoskeletal symptoms in COVID-19 and rehabilitation. Besides, this study was to describe a 70-year-old male patient post-COVID-19, including the description of physical therapy interventions and their effects on various outcome measures such as oxygen saturation, heart rate, and function. **Methods:** A literature search on databases using keywords (exercises, rehabilitation, physical therapy, COVID-19, musculoskeletal) was done. As well, a 70-year-old male post-ICU patient was physically assessed and underwent physical therapy interventions. **Results:** COVID-19 had a significant negative impact on patients, musculoskeletal and general health. Several physiotherapeutic interventions were reported. Exercise significantly improved the disability of a 70-year-old male post-ICU patient. **Conclusion:** Musculoskeletal symptoms are prevalent among COVID-19 patients, which negatively affect function. Physical therapy, especially exercises, is crucial for the management of musculoskeletal symptoms and associated disability in post-COVID-19 patients.

Keywords: COVID-19, Exercises, Musculoskeletal, Rehabilitation.

Introduction

Coronavirus disease 2019 (COVID-19) in humans is a fatal respiratory disorder caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It started and suddenly rose in Wuhan, China, then became a pandemic affecting many areas worldwide. [1,2] COVID-19 symptoms include elevated temperature, dry coughing, sputum production, breathlessness, hypoxemia, itchy throat, headache, chills, vomiting, nasal blockage, diffuse alveolar damage, hemoptysis, smell and taste disturbances, conjunctival congestion, dysphagia, and symptoms of the neuropsychological and musculo-skeletal systems.[2-4]

Among the musculo-skeletal symptoms are muscle and joint aches, muscle weakness, fatigue, back pain, and sarcopenia. [5] About ¾ and 2/5 of the patients had at least one of these symptoms at 3 and 6 months, respectively. [6]

However, studies to assess, treat, or rehabilitate the disability resulting from symptoms of the musculoskeletal system are lacking, and the authors of previous studies recommend performing further studies in this regard. [7]

Therefore, the objective of this research is to identify the musculoskeletal symptoms associated with COVID-19, including their prevalence, mechanisms, and negative effects from previous literature. As well, it tries to investigate the effects of addressing these musculoskeletal problems with individualised physiotherapy interventions on several outcomes, including function, in a case study.

Musculoskeletal symptoms in COVID-19 patients:

Muscle pain and inflammation:

COVID-19 survivors affect up to 50% of that population. [6,8] This condition may be due to either a direct viral attack of the muscle or an immune-mediated cytokine storm with subsequent inflammation and muscle damage. [8,9]

Muscle inflammation, myositis, or rhabdomyolysis (with muscle infarction or necrosis). This condition is associated with muscle aches and weakness.[8,10]

Fibromyalgia is common among post-COVID-19 survivors. It was reported to affect 31% to 40% of the patients. This supports the effect of the virus on inducing rheumatic and autoimmune diseases that affect the musculoskeletal system.[11]

Muscle dysfunction of the diaphragm is prevalent among patients with COVID-19. This problem may emerge from ACE2-associated myopathy and muscle fibrosis, ventilator use, or a direct phrenic nerve lesion. [12,13]

Muscle loss, myopenia, or sarcopenia is a chronic condition associated with COVID-19.[8] Old age, poor nutrition, and sedentary lifestyles are contributing factors for this condition.[14]

Joint pain and arthritis:

Joint pain, or arthralgia, is more common with COVID-19 than arthritis. [15] It affects 2–65% of patients up to 1 year post-COVID-19.[6,11,16] However, inflammatory arthropathies or arthritis (e.g., rheumatic and psoriatic) were reported in several case studies and confirmed by synovitis seen on imaging. [18] Another cause of joint pain in primary septic joint infections may be immunosuppression. [19]

Pain of the musculoskeletal system (joint and muscle pain) is a chronic and significant symptom of COVID-19 that may be generalised or localized.[5,20] It is more likely to occur in female patients.[6]

Musculoskeletal pain frequently affects the spine or the back, which may be associated with spodyloarthropathy, muscle pain, inflammation, and/or fatigue.[21]

Bone loss:

Bone loss in the form of osteoporosis and/or osteonecrosis was described in COVID-19 cases. [22,23] Bone losses were seen at different sites in animals with COVID-19.24. This condition may develop from coagulopathy, a critical illness of the virus, medications such as cortisone, direct infection of bone marrow macrophages, an autoimmune reaction with inflammation, oxidative stress, or hypoxia. [22-24]

Fatigue:

Fatigue is very common among COVID-19 patients. It was reported to affect 31.6% of the patients. Fatigue more likely affects female patients at 6 months post-infection. [6,7]

Risk factors for chronic musculoskeletal disorders:

All of these musculoskeletal symptoms can persist and contribute to long-term or post-COVID-19 disease in the presence of a number of risk factors, including chronic diseases, females increased body weight, old age, a long period of immobility and hospital stay, mechanical ventilator use, not having a vaccination, lower lymphocyte and higher d-dimer levels, and early back pain. [5,21]

Impact of musculoskeletal symptoms on disability:

Musculoskeletal symptoms were reported to negatively affect function and ADLs in several previous studies.[25,26]

As well, Evcik (2023)[5] reported that these symptoms are associated with limited capability to perform physical function and exercises in COVID-19 survivors. Furthermore, Dos Santos et al. (2022)[27] found that COVID-19 reduces the life quality of the affected patients, which may be due to the high prevalence of musculoskeletal symptoms in this population.

The recovery from all of these manifestations may require several months after release from the hospital, causing a marked reduction in function and life quality. [28] So, rehabilitation is recommended in the in the early post-ICU acute phase. [26,28]

Role of physiotherapy:

Physiotherapists help COVID-19 survivors progressively improve and monitor their physical function, including activity level, in the early period (about 2 months) after infection or release from the hospital.[29] Besides breathing exercises, COVID-19 patients respond positively to physiotherapy, including exercises.[25] Physiotherapy helps COVID-19 survivors wean from oxygen support and recover early by preventing the weakness associated with ICU and enhancing the pulmonary functions.[30,31]

Physiotherapy interventions include breathing control, chest excursion, respiratory muscle strengthening, airway clearance, bed mobility activities, active assistive and free range of motion, training on transfer and daily activities, walking, and cycle ergometers[32,33], with the help of electrical stimulation[34], to improve respiratory, physical, psychological, and social status.[29]

Exercise targeting respiratory muscles as well as stretching and home exercises improved lung capacity, endurance, and psychosocial status.[35] As well, it helps return to daily and leisure activities.[36] Exercises enhance the production of "anti-inflammatory cytokines." [4] Physiotherapy, medication, and psychological support can improve the psychological status of COVID-19 patients. [37] Electrotherapy of the antigravity muscles improves COVID-19 patients' ability to sustain vertical positions and do the exercises easily. [38]

More studies and clinical information are needed to determine the best type of exercise that is beneficial in COVID-19 management and reduce the caution in dealing with them.[3,26,33] Moreover, further guidance for the management of COVID-19 survivors is warranted despite the presence of previous guidelines because the previous ones lack accurate knowledge about those patients. [25]

Case Presentation

A.A. A 70-year-old man was admitted to the ICU on May 15, 2021, with a diagnosis of COVID-19 with 20% lung involvement. He had no associated comorbidities. The patient was on "continuous positive airway pressure (CPAP)" with 80% "fraction of inspired oxygen (FiO2)". He had a prolonged hospital stay of 1.5 months. He was discharged on June 28, 2021. At home, he was on oxygen support with a mask and a nasal prong. Oxygen (O2) was 4 L/min. His SPO2 was 85%. His single breath count was 18. He was unable to assume an upright sitting or standing position and could not walk independently. He had a grade 3 on the manual muscle test. He had a knee extension loss of 5 degrees with hip neutral. His SLR angle was 55 degrees. BBS score was 16. The Barthel index of ADL was 25. Heart rate was 90 BPM.

Physiotherapy interventions at home were performed at a rate of 2 to 3 weekly sessions for 1.5 months and included the following:

1. Electrical muscle stimulation for quadriceps and dorsi-flexor muscles.[39]
2. Active free then progressed to active resistive exercises for upper and lower limbs (about 2 sets of 10 repetitions and resting 2 minutes in-between sets). The load was increased by about 10% weekly).[25,29,40,41]
3. Hamstring and calf muscles stretching exercises
4. Core exercises include transverse abdominis and multifidus activation and bridging. [25,29]
5. Pelvic floor exercises.
6. Chest expansion or mobility exercises.[41]
7. "Active Cycle Breathing Technique (ACBT)": this technique was applied in 3 steps; A-Breathing control: The patient was asked to keep eyes closed and shoulders relaxed while gently inhaling via the nose and focusing on breathing. This enhances relaxation and reduces breathing difficulty and chest tightness. B-Deep breathing: The patient was asked to inhale deeply and slowly via the nose, hold for 2-3 seconds, and exhale gently in a relaxed manner like a sigh. C-forced expiration: The patient was asked to inhale deeply and exhale via the mouth in one phase. [30] This technique aims to enhance pulmonary functions and clear the chest. [42]
8. Pursed lip breathing (breathing control) was performed for 5 cycles. [29]
9. Diaphragmatic breathing was performed for 5 cycles.[29]
10. "Proprioceptive Neuromuscular Facilitation (PNF) of Respiration": The patient was made in a supine-lying position. The researcher put his open hands on the lower 4-5 ribs laterally on both sides for resistance. The patient was asked to inhale deeply and hold for 5 seconds at the end. At

that moment, the researcher applied minimal resistance by applying medial and downward pressure with both hands. Then, the patient was asked to exhale deeply, and the researcher applied resistance at the end, similar to inhalation. This was performed 10 times. [43] This method improves proprioception by reflexively activating the muscles of respiration, improving chest expansion and pulmonary function. [44]

11. Single breath and count.[41]
12. Percussion on the front and back of the chest.
13. In spirometer[41], the patient was asked to do 10 breathing cycles every 2 hours. [25]
14. Rolling (supine to both sides, side to prone, prone to side).
15. Positioning: the patient was put in prone-lying, turning the face to one side for ≥5 minutes as tolerated, and the patient was asked to do this for 3 to 4 repetitions daily. [30,41,45]
16. Transfer (supine to sit and sit to stand).
17. Walk 15 metres 5–10 times and progress. [29,41,46]
18. Balance training (balance) was challenged by decreasing hand support, base of support (feet together and tandem), visual input (closing eye), and stability of the surface (stand on pillows). [40]
19. Stair climbing.[25]

This programme was done by the author, who attended e Evidence-Based M Medicine for Clinical Practice of COVID-19 course at the Egyptian Knowledge Bank. He is a physiotherapist with 14 years of experience.

This programme progressed gradually as the patient's state lowed. The session was about one hour, with several rest periods as needed via monitoring vitals. [41] The sessions were done 2-3 times weekly for 2.5 months.

During exercise, the saturation of oxygen, or SpO2, is checked for early identification of desaturation. Therefore, SpO2 was assessed before, during, and just after each exercise or activity, especially in cases of fatigue and/or dyspnea.

Exercises were stopped in cases of: temperature >37.2-38°; worsening or severe dyspnea; respiratory rate > 30 breaths/min; SpO_2 drops 4% or reaches < 85%; chest tightness, respiratory distress, faintness, headache, impaired vision, sweating, impaired balance; blood pressure >140/90 or <90/60 mmHg; HR >100-120 beats/min; and fatigue not relieved with rest. [25,26,40,47]

The patient was assessed using a pulse oximeter (oxygen saturation, SpO2, and heart rate) and a single breath count. ROM and manual muscle testing were done. Balance and ADL assessments were assessed using the Berg balance scale and the Barthel index, respectively. [40,41]

At the end of the programme and the treatment sessions, he was off oxygen, SPO2 was 100%, able to sit, stand statically and dynamically, walk independently, and do his ADL activities. He can count 25 on a single breath count. He had a grade 4 on the manual muscle test. He had no knee extension loss of 5 degrees with hip neutral. His SLR angle was 70 degrees. BBS score was 51. The heart rate was 82 BPM. The Barthel index of ADL was 90.

Discussion

This study presented a case of post-COVID syndrome and significant respiratory, musculoskeletal, neurological, bowel, bladder, and psychological problems. He was on 4 L/min O2, SPO2 was 85%, HR was 90, unable to sit or stand upright for a while, unable to walk or negotiate stairs, unable to control the bowel and bladder.

He was treated at home with a physical therapy programme including exercises to improve respiration, chest expansion, range of motion, strength, bowel and bladder control, mobility, balance, and walking with the help of electrical stimulation.

After the end of the treatment, he was off O2 and was able to sit, stand, walk, and climb stairs independently.

Physiotherapy interventions that target musculoskeletal symptoms in addition to respiratory ones can decrease the need for oxygen support, enhance functional and pulmonary capacity, and, as a consequence, help patients with COVID-19 recover early. [29,45]

This study supports the role of exercises and electrical stimulation in treating patients with COVID-19 that improve respiratory, physical, psychological, and social status. [29,34-38]

These findings may provide some of the clinical information needed to determine the musculoskeletal symptoms and their effect on

physical function. As well, it gave a description of the most common and effective types of exercises in the recovery of COVID-19 survivors that may lead to proper and easy dealing with those population.[3,26,33]

Conclusion

COVID-19 survivors commonly have musculoskeletal symptoms, besides respiratory problems, that affect function. Physiotherapy significantly improved these symptoms and, hence, functional ability in this case of post-COVID-19 syndrome.

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Disclosure

The author declares that there are no conflicts of interests.

Consent form

Consent was obtained from the patient before starting the study.

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