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Original Article

Musculoskeletal and Neurological Examination Findings in Post-COVID-19

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ABSTRACT

Background: This study investigated the musculoskeletal and neurological examination findings in symptomatic patients who had previously experienced COVID-19.

Material and Methods: A prospective cohort of 101 patients who had been diagnosed with COVID-19 between January and April 2021 was included in this study. These patients received medication treatment and were followed up but did not require intensive care unit (ICU) admission. The patients' symptoms, dysfunctional segments identified through cervical and thoracic examinations, and visual analog scale (VAS) scores were analyzed.

Results: Myalgia (63%) was the most commonly reported symptom in the post-COVID-19 period. The T5 segment (23%) was the most frequently observed dysfunctional segment. Older individuals had a higher VAS score and a statistically significant correlation was found between age and VAS scores (p=0.013 and r2: 0.265).

Conclusion: This study highlights the prevalence of myalgia as a common symptom in patients who have previously had COVID-19 and emphasizes the importance of assessing the T5 segment for managing pain and facilitating pulmonary rehabilitation in such individuals. These findings can contribute to the development of more effective treatment strategies for post-COVID-19 patients experiencing musculoskeletal symptoms.

Keywords: Post COVID-19, pulmonary rehabilitation, dysfunctional segment, myalgia, pain

INTRODUCTION

The COVID-19 pandemic has affected millions of people worldwide, causing a range of health issues and complications. While the primary respiratory symptoms of COVID-19 are well-known, emerging evidence suggests that the virus can also have musculoskeletal manifestations (1-3). Many individuals who have recovered from COVID-19 report experiencing persistent musculoskeletal symptoms, such as muscle aches, joint pain, and generalized discomfort (3,4). These symptoms can significantly impact an individual's quality of life, physical functioning, and overall well-being. Therefore, it is crucial for healthcare providers and patients alike to recognize and manage these post-COVID-19 musculoskeletal symptoms effectively.

There are numerous studies in the literature regarding musculoskeletal involvements following COVID-19 (1-4). Muscles and joints (commonly affecting the shoulders, neck, back, and limbs), spine (the cervical and thoracic regions of the spine; with symptoms such as neck pain, stiffness, and discomfort in the upper back region), chest wall (chest wall pain or discomfort), extremities (affect the arms and legs, including symptoms such as limb weakness, muscle fatigue, and joint stiffness) (2,5,6). However, data regarding these involvements' segmental patterns and frequency are still limited.

This study aims to investigate the musculoskeletal and neurological examination findings of non-hospitalized symptomatic post-COVID-19 patients to determine

whether there is specific segmental involvement.

MATERIAL AND METHODS

Study Design and Participants

This descriptive study included 101 patients who had previously experienced COVID-19 and presented to the Physical Therapy and Rehabilitation (PTR) outpatient clinic of Medicana International Hospital Between January-April 2021 following a documented COVID-19 within recent 4-12 weeks. Patients who had been admitted to the intensive care unit (ICU) and required a prolonged hospitalization were excluded from the study. The study data included variables such as age, gender, patient complaints (a list of complaints was given, and participants were asked to select the options that described their discomfort), dysfunctional segments identified through cervical and thoracic examinations, and Visual Analog Scale (VAS) scores assessed by an experienced physician.

Inclusion and Exclusion Criteria

Patients who were referred to PTR due to post-COVID-19 persistent musculoskeletal discomfort were enrolled in the study. Participants with acute illness and known neuropathy, including dyscopathy, were excluded This study was conducted in agreement with the Declaration of Helsinki-Ethical principle for medical research involving human subjects.

STATISTICAL ANALYSIS

The study utilized descriptive statistics (mean and ± standard deviation), chi-square test, scatter plot with correlation analysis, regression analysis, and independent samples t-test (possibly) to analyze the data by using SPSS 13.0 for Windows. $p<0.05$ was assigned as significant

RESULTS

The demographical and clinical features of 101 patients were given in Table 1. Of the patients included in the study, 63% were male, while 37% were female. The average age of all patients with post-COVID-19 syndrome was 38.6±12.2. The average age for males was 41.9±11.3, and for females, it was 36.7±10.89. Myalgia was the most frequently reported symptom, accounting for 63% of cases. The frequency of symptoms between genders was similar (p=0.658). Age and sex have no impact on symptom development (p=0.329 and p=0.512, respectively).

Table 1. The characteristics of the participants

Age, years	38.6±12.2
Sex, male/female, n=	63/38
Mean postCOVID-19 duration	18 days
Symptoms, %	
• Myalgia	63
• Fatigue	53
• Shortness of Breath	24
• Chest Pain and Palpitations	25
• Sleep Disorders	22
• Loss of Smell and Taste	13
• Gastrointestinal Symptoms	23

The study examined the presence of dysfunction in specific segments of the cervical and thoracic regions in post-COVID-19 patients. It was found that 23% of the patients had dysfunction in the T5 segment. Following that, dysfunction was observed in 16% of patients in the C2 and T6 regions, 13% in the C4 region, and 11% in the T4 region (**Table 2**).

Younger patients were at lower and higher VAS scores, while older patients were at higher VAS scores, given the scatter plot between these two variables. A statistically significant relationship was found between age and VAS scores (p=0.013 and r2: 0.265).

These findings suggest that dysfunction in specific segments of the cervical and thoracic regions is common in post-COVID-19 patients, with the T5 segment being the most frequently affected.

Table 2. The affected segments of patients included in the study

T5: 23 cases (23%)
C2: 16 cases (16%)
T6: 16 cases (16%)
C4: 13 cases (13%)
T4: 11 cases (11%)
T9: 8 cases (8%)
T3: 6 cases (6%)
T8: 5 cases (5%)
T7: 2 cases (2%)
T10: 1 case (1%)
Total: 101 cases (100%)

DISCUSSION

This study aimed to investigate the musculoskeletal and neurological examination findings in symptomatic patients who had previously experienced COVID-19. The findings provide valuable insights into the prevalence of symptoms, dysfunctional segments, and their implications for pain management and pulmonary rehabilitation in post-COVID-19 patients.

In the literature, the prevalence of arthralgia or myalgia in patients with COVID-19 varies. In a retrospective cohort study conducted by Hoong et al, involving 294 hospitalized patients with COVID-19, it was observed that 30% of patients reported musculoskeletal complaints. Among those with musculoskeletal complaints, the study found that 37.5% experienced myalgia, 5.7% had

arthralgia, 6.8% reported new-onset backache and 50% had generalized body ache (7). However, myalgia can occur in a range of 15.5-68% in previous studies (7,8). It is difficult for many physicians to differentiate a specific involvement type when patients describe a generalized pain. The most commonly reported symptom in this study was myalgia, with a prevalence of 63%. This aligns with existing literature that suggests muscle pain is a common complaint among individuals recovering from COVID-19. The high prevalence of myalgia diagnosis in this cohort may be attributed to patients being referred to a physical therapy specialist based on their complaints.
In terms of dysfunctional segments identified through cervical and thoracic examinations, the T5 segment was the most frequently affected, observed in 23% of the patients. Dysfunctions in the C2 and T6 regions were also relatively common (16%), followed by the C4 (13%) and T4 (11%) regions. These findings indicate the potential involvement of specific spinal segments in post-COVID-19 musculoskeletal issues. Understanding the pattern of dysfunction can guide healthcare providers in developing individualized treatment plans, including manual therapy, exercise, and rehabilitation strategies, to address segment-specific impairments.

Pain assessment using the VAS scores revealed a statistically significant relationship between age and pain levels, indicating that older patients tended to report higher levels of pain or discomfort. This observation suggests that age may be a contributing factor to the severity of musculoskeletal symptoms experienced by post-COVID-19 patients. The impact of age on pain perception and functional outcomes should be taken into consideration when designing rehabilitation programs for this population. Cevei et al. highlighted the need for post-acute rehabilitation after COVID-19, especially in elderly people with underlying health problems (9). Previous studies have shown that during the post-COVID-19 period, many symptoms have adversely affected the quality of life and functional capacity over a 6-month period. The priority of treatment should be given to cardiopulmonary, psychiatric, and musculoskeletal rehabilitation (10).

The findings of this study have clinical implications for the management of post-COVID-19 musculoskeletal symptoms. Considering the high prevalence of myalgia, healthcare providers should prioritize pain management strategies tailored to individual patients. Addressing dysfunctional segments, particularly the commonly affected T5 segment, through targeted interventions such as manual therapy and specific exercises, may help improve functional outcomes and alleviate musculoskeletal discomfort.

Furthermore, incorporating pulmonary rehabilitation in the post-COVID-19 rehabilitation programs is warranted (9,10). Given the relationship between dysfunctional segments and pain, addressing these issues may positively impact respiratory function and overall rehabilitation outcomes. Pulmonary rehabilitation programs can help individuals recovering from COVID-19 regain their respiratory capacity, enhance physical endurance, and improve their quality of life (9-12).

It is important to note that this study had some limitations. The sample size was relatively small, and the data was collected from a single center, which may limit the generalizability of the findings. Additionally, the study focused on patients who did not require ICU admission, potentially excluding those with more severe cases of COVID-19. Future research with larger and more diverse cohorts is needed to validate and expand upon these findings.

In conclusion, this study provides valuable insights into the musculoskeletal and neurological examination findings in post-COVID-19 patients. Myalgia was the most commonly reported symptom, and dysfunction in specific cervical and thoracic segments, particularly the T5 segment, was frequently observed. Understanding these findings can guide the development of targeted rehabilitation strategies for managing musculoskeletal symptoms and improving overall functional outcomes in individuals recovering from COVID-19. Further research is warranted to explore the long-term effects of COVID-19 on the musculoskeletal system and optimize rehabilitation interventions for post-COVID-19 patients.

DECLARATIONS

Ethics Committee Approval: Medicana International **Hospital Ethics Committee Approval No:** BŞH:2020/14

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Conflict of Interest: None

Informed Consent Form: Since the study was a retrospective analysis, no consent was required as per the then-regulations.

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