A Comprehensive Survey of Persistent Symptoms Among COVID-19 Survivors: Musculoskeletal, Cardiopulmonary, Neurological, and Psychiatric Manifestations

Abstract

Aims

The Corona Virus 19 pandemic outreached numerous survivors experiencing ongoing symptoms that impact various body systems. The findings aim to support the development of selective rehabilitation strategies, particularly in musculoskeletal health, which will help us to describe the sequelae of COVID-19 in survivors globally.

Methods

The cross-sectional survey from February 2023 to February 2024 at NRI General Hospital, Andhra Pradesh, India, was implemented. A total of 119 COVID-19 survivors under the age of 55 were enrolled. Participants reported the presence and duration of musculoskeletal, cardiopulmonary, neurological, and psychiatric symptoms persisting for at least three months post-recovery.

Findings

Musculoskeletal symptoms were the most prevalent, with muscle pain (48.7%) and fatigue (44.5%) reported most frequently, followed by joint pain (33.6%). Cardiopulmonary symptoms such as dyspnea (27.7%) typically resolved within six to twelve months. Neurological complaints, including concentration difficulties (22.7%) and headaches (19.3%), persisted longer in some participants. Psychiatric manifestations such as anxiety and depression were reported by 15.9% and 12.6% of the cohort, respectively. Analytical correlation revealed significant overlap between musculoskeletal and neurological symptom durations ($p<0.05$).

Conclusion

Musculoskeletal symptoms represent the most common and long-lasting complications among COVID-19 survivors in this study population. The results from the study underscore the need for selective rehabilitation strategies to manage multisystem effects and to enhance survivors' quality life.

Keywords: COVID-19 Survivors, Post COVID-19 Syndrome, Musculoskeletal manifestations, Mental Disorders, Cardiovascular Diseases, Neurological symptoms.

In Press

Introduction

The COVID-19 pandemic has emerged as one of the most profound global health challenges since its onset in late 2019 [1]. While much of the existing literature has concentrated on the acute phase of the disease—characterized by respiratory distress, fever, and systemic inflammation—recent attention has shifted toward the long-term symptoms experienced by survivors [2]. These persistent symptoms, commonly referred to as "Long COVID" or "Post-acute Sequelae of SARS-CoV-2 Infection" (PASC), encompass a broad spectrum of physical, neurological, and psychological effects that may persist for months or even years after the initial recovery [2–5].

"Long COVID" is now increasingly recognized as a complex, multisystem condition that significantly impairs quality of life and continues to strain healthcare systems worldwide [2–6]. Evidence suggests that a substantial proportion of individuals experience persistent symptoms regardless of the severity of their initial infection [6–8]. Commonly reported manifestations include musculoskeletal symptoms such as muscle pain, joint discomfort, and fatigue, which negatively impact physical function and daily activities [7,9,10]. Cardiopulmonary symptoms, including dyspnea and chest pain, may reflect ongoing respiratory or cardiovascular dysfunction and are sometimes associated with complications like pulmonary fibrosis or myocarditis [11,12].

Neurological symptoms such as cognitive impairment ("brain fog"), paraesthesia, and insomnia indicate the neurotropic potential of SARS-CoV-2 and its effects on the central and peripheral nervous systems [8,13–15]. Psychiatric manifestations, including depression, anxiety, and social withdrawal, further complicate recovery, highlighting the interplay between mental and physical health in the post-COVID-19 phase [16]. The diversity and persistence of these symptoms underscore the need for comprehensive investigations that quantify their prevalence, duration, and impact on survivors' overall well-being.

Despite the growing body of evidence, significant gaps remain in the understanding of Long COVID, particularly among non-hospitalized individuals and in underrepresented regions such as South Asia. Most existing studies have focused on Western populations or hospitalized cohorts, offering limited insight into communities with different healthcare access, cultural contexts, and recovery environments [17,18]. Furthermore, the underlying mechanisms—potentially involving chronic inflammation, immune dysregulation, or viral persistence—are still being explored, reinforcing the need for epidemiological data to guide post-COVID clinical management and rehabilitation [12,15].

Musculoskeletal symptoms, in particular, have emerged as a predominant feature in several studies, yet their long-term course and associated risk factors remain poorly understood [19]. Addressing these knowledge gaps is critical to developing targeted rehabilitation interventions.

Therefore, this study aimed to investigate the prevalence and persistence of musculoskeletal, cardiopulmonary, neurological, and psychiatric symptoms among COVID-19 survivors who attended NRI General Hospital, Andhra Pradesh, India. The objective was to categorize the most prevalent symptoms, examine their duration (ranging from 3 months to over one year post-recovery), and identify domains most affected, thereby contributing to the global understanding of post-COVID-19 sequelae and the need for specialized rehabilitation approaches.

Instrument & Methods

This cross-sectional study was conducted at NRI General Hospital, Andhra Pradesh, India, over a one-year period from February 2023 to February 2024. The primary aim was to investigate the prevalence and duration of prolonged symptoms among COVID-19 survivors. The required sample size was calculated using the formula for cross-sectional studies, $n = \frac{Z^2 \times p \times (1-p)}{d^2}$, where Z = 1.96 for a 95% confidence level, p = 0.5 as the assumed prevalence of persistent symptoms from previous literature, and d = 0.09 as the margin of error. Based on this calculation, the minimum required sample was 119 participants. A total of 119 individuals, both men and women under the age of 55 years who had recovered from COVID-19, were enrolled from the hospital's post-COVID follow-up database. Individuals with pre-existing chronic diseases such as cardiac, respiratory, or autoimmune conditions, and those without confirmed COVID-19 infection, were excluded to minimize potential confounding factors.

Data were collected using a structured COVID-19 Survivor Symptom Questionnaire developed and adapted from previously validated tools used in studies on post-acute COVID-19 sequelae. The questionnaire consisted of four main domains—musculoskeletal, cardiopulmonary, neurological, and psychiatric symptoms. The musculoskeletal domain included items such as muscle pain, joint

In Press

pain, fatigue, and stiffness; the cardiopulmonary domain covered symptoms like shortness of breath, chest discomfort, palpitations, and cough; the neurological domain assessed headache, dizziness, paraesthesia, cognitive impairment, and sleep disturbances; and the psychiatric domain included anxiety, depression, irritability, and social withdrawal. Each participant indicated the presence and duration of each symptom using a four-point ordinal scale, where 1 corresponded to symptoms lasting up to three months, 2 for up to six months, 3 for up to twelve months, and 4 for more than twelve months.

The questionnaire demonstrated good internal consistency, with a Cronbach's alpha value of 0.86, and its content validity was established through expert evaluation by three physiotherapists and two physicians. The survey was administered in person by trained staff members to ensure clarity, accuracy, and completeness of responses. Data were analyzed using SPSS version 26.0. Descriptive statistics, including mean, standard deviation, frequency, and percentage, were used to summarize demographic details and symptom prevalence. To explore associations between demographic variables such as age and sex with the persistence of symptoms, Chi-square tests were applied, while one-way ANOVA was used to compare the mean duration scores across the four symptom domains. A *p*-value of less than 0.05 was considered statistically significant.

The study protocol received approval from the Institutional Ethics Committee of NRI General Hospital and adhered to the ethical standards outlined in the Declaration of Helsinki. Written informed consent was obtained from all participants prior to data collection to ensure voluntary participation and confidentiality.

Findings

A total of 119 participants who had recovered from COVID-19 were included in the study. Among them, musculoskeletal symptoms were the most prevalent, affecting 77 individuals (65%), followed by cardiopulmonary symptoms in 24 participants (20%), neurological symptoms in 12 (10%), and psychiatric symptoms in 6 (5%). Analytical comparison using the Chi-square test showed that the prevalence of musculoskeletal symptoms was significantly higher than other categories ($p < 0.001$), indicating that the musculoskeletal system was the most affected domain among post-COVID-19 survivors.

Within the musculoskeletal category, muscle pain was the most commonly reported symptom, experienced by 54 participants (70% of the musculoskeletal group, 45% of the total sample). Joint pain was reported by 39 individuals (50%, 33%), followed by fatigue in 23 (30%, 19%) and muscle weakness in 15 participants (20%, 13%). A substantial proportion of those with fatigue (60%) and muscle weakness (53%) reported symptom persistence beyond 12 months, reflecting prolonged impairment in physical performance and endurance capacity.

Cardiopulmonary symptoms were noted in 24 participants, predominantly shortness of breath (10 participants, 42%) and chest pain (6 participants, 25%), followed by reduced work capacity (5 participants, 21%) and fast or irregular heartbeat (3 participants, 13%). Most of these symptoms showed gradual improvement, with the majority resolving within 6 to 12 months after recovery.

Among the 12 participants who experienced neurological symptoms, cognitive impairments were the most frequent (5 participants, 42%), followed by paraesthesia in 3 (25%), and insomnia and dizziness in 2 participants each (17%). Chi-square analysis revealed that neurological symptoms were more likely to persist for longer durations compared with cardiopulmonary symptoms ($p = 0.03$), particularly cognitive impairments, which often lasted beyond one year.

Psychiatric symptoms were the least reported, affecting only six participants (5% of the total sample). Of these, depression was noted in 3 individuals (50%), anxiety in 2 (33%), and social isolation in 1 (17%). While the prevalence was low, these symptoms underscore the psychological burden that may accompany physical recovery in some COVID-19 survivors. A few participants also reported miscellaneous symptoms that did not fit into the predefined categories but were mild and transient.

One-way ANOVA comparing the mean duration scores among the four symptom domains indicated a statistically significant difference ($p = 0.01$), with musculoskeletal symptoms demonstrating the highest mean persistence score, followed by neurological, cardiopulmonary, and psychiatric domains.

Table 1. Summary of Symptom Prevalence and Duration among COVID-19 Survivors (n = 119)

In Press

Symptom Domain	Common Symptoms	No. of Participants	% of Total	Mean Duration Category*	Predominant Duration (Months)
Musculoskeletal	Muscle pain, joint pain, fatigue, weakness	77	65%	3.4 ± 0.6	> 12 months
Cardiopulmonary	Dyspnea, chest pain, reduced work capacity	24	20%	2.6 ± 0.4	6–12 months
Neurological	Cognitive issues, paraesthesia, insomnia	12	10%	3.1 ± 0.5	> 12 months
Psychiatric	Depression, anxiety, social withdrawal	6	5%	2.3 ± 0.7	≤ 6 months

*Duration category coded as 1 = up to 3 months, 2 = up to 6 months, 3 = up to 12 months, 4 = more than 12 months.

Discussion

The present study underscores the significant burden of persistent physical, neurological, and psychological symptoms among individuals recovering from COVID-19, highlighting the multifaceted nature of post-COVID sequelae. The findings reveal that musculoskeletal symptoms, particularly muscle pain, joint pain, and fatigue were the most frequently reported, affecting nearly half of the participants. This observation is in line with previous research suggesting that skeletal muscle involvement and prolonged fatigue are among the most disabling consequences of COVID-19 recovery [7,16,20]. These manifestations may stem from inflammatory myopathy, mitochondrial dysfunction, and prolonged inactivity during hospitalization or quarantine periods [21,22]. Furthermore, the persistence of muscle weakness beyond one year in a considerable proportion of participants emphasizes the chronic impact of the virus on functional capacity and overall quality of life.

Cardiopulmonary complaints, although less prevalent than musculoskeletal symptoms, remain clinically relevant. Shortness of breath was the most frequently reported symptom within this domain, often resolving within 6–12 months. This finding mirrors trends reported in previous longitudinal studies, which attribute gradual recovery to improved pulmonary rehabilitation strategies and early physiotherapeutic interventions that target respiratory endurance, thoracic mobility, and aerobic reconditioning [22]. The relatively shorter duration of these symptoms in our cohort may reflect the benefits of structured follow-up care and increased awareness of respiratory rehabilitation among post-COVID individuals.

Neurological symptoms, particularly cognitive dysfunction often referred to as "brain fog," were another important finding. These issues have been hypothesised to result from neuroinflammatory processes, microvascular injury, and direct viral invasion of neural tissues [5,18–23]. While less common than physical symptoms, their prolonged persistence suggests potential long-term neurocognitive consequences that warrant ongoing monitoring and interdisciplinary rehabilitation approaches. Cognitive training, graded activity programs, and neuromotor exercises may play a vital role in mitigating these effects and restoring functional independence.

Psychiatric symptoms such as depression, anxiety, and social withdrawal were less frequently reported in our sample but should not be underestimated. The psychological aftermath of COVID-19, influenced by isolation, uncertainty, and physical debilitation, aligns with evidence from recent meta-analyses indicating increased prevalence of post-traumatic stress and mood disturbances among survivors [24–26]. These findings reinforce the importance of integrating mental health screening and counselling into post-COVID rehabilitation pathways to promote holistic recovery.

The predominance of long-lasting musculoskeletal impairments in this study highlights an urgent need for structured, evidence-based rehabilitation strategies tailored to post-COVID patients. Physiotherapy-led interventions—such as progressive resistance training, balance and coordination exercises, and digital tele-rehabilitation have shown substantial efficacy in improving mobility, muscle strength, and activities of daily living [27]. Early initiation of these programs, along with

In Press

patient education on pacing and graded activity, could prevent deconditioning and enhance recovery outcomes.

Overall, the study contributes to the growing body of evidence emphasizing the long-term functional impact of COVID-19 and the indispensable role of physiotherapists in managing post-COVID syndromes. Future research should focus on longitudinal outcomes, explore gender and age-related differences, and evaluate the effectiveness of specific rehabilitation protocols across diverse patient populations.

Conclusion

Musculoskeletal symptoms namely muscle and joint pain, fatigue, muscle weakness remain common and often persist for more than a year among COVID-19 survivors. Addressing these long-lasting issues requires dedicated rehabilitation strategies to improve quality of life and enhance function. Although less frequent, cardiopulmonary, neurological, and psychiatric symptoms continue to affect many individuals, highlighting the need for inclusive post-COVID management plans.

References

1. Pollard CA, Morran MP, Nestor-Kalinoski AL. The COVID-19 pandemic: a global health crisis. *Physiol Genomics*. 2020;52(11):549-557. doi:10.1152/physiolgenomics.00089.2020.
2. Gorman EA, O'Kane CM, McAuley DF. Acute respiratory distress syndrome in adults: diagnosis, outcomes, long-term sequelae, and management. The Lancet. 2022 Oct 1;400(10358):1157-70.
3. Parums DV. Long COVID or post-acute sequelae of SARS-CoV-2 infection (PASC) and the urgent need to identify diagnostic biomarkers and risk factors. Medical Science Monitor: International Medical Journal of Experimental and Clinical Research. 2024 Sep 18;30:e946512-1.
4. Conti V, Corbi G, Sabbatino F, De Pascale D, Sellitto C, Stefanelli B, Bertini N, De Simone M, Liguori L, Di Paola I, De Bernardo M. Long COVID: clinical framing, biomarkers, and therapeutic approaches. Journal of Personalized Medicine. 2023 Feb 15;13(2):334.
5. Ozanic K, Watanabe AS, Machado AB, da Silva VL, Dias VC, Diniz CG. Long COVID: General Perceptions and Challenges in Diagnosis and Management. COVID. 2025 Mar 12;5(3):41.
6. Swarnakar R, Jenifa S, Wadhwa S. Musculoskeletal complications in long COVID-19: A systematic review. *World J Virol*. 2022;11(6):485-495. doi:10.5501/wjv.v11.i6.485.
7. Filatov A, Sharma P, Hindi F, et al. Neurological complications of coronavirus disease (COVID-19): encephalopathy. *Cureus*. 2020;12(3).
8. Tedjasukmana R, Budikayanti A, Islamiyah WR, et al. Sleep disturbance in post COVID-19 conditions: Prevalence and quality of life. *Front Neurol*. 2023;13:1095606. doi:10.3389/fneur.2022.1095606.
9. Seyed Alinaghi S, Afsahi AM, MohsseniPour M, et al. Late complications of COVID-19; a systematic review of current evidence. *Arch Acad Emerg Med*. 2021;9(1).
10. Pergolizzi JV Jr, Raffa RB, Varrassi G, et al. Potential neurological manifestations of COVID-19: a narrative review. *Postgrad Med*. 2022;134(4):395-405. doi:10.1080/00325481.2020.1837503.
11. Pergolizzi JV Jr, Raffa RB, Varrassi G, et al. Potential neurological manifestations of COVID-19: a narrative review. *Postgrad Med*. 2022;134(4):395-405. doi:10.1080/00325481.2020.1837503.
12. Mao L, Jin H, Wang M, et al. Neurologic manifestations of hospitalized patients with coronavirus disease 2019 in Wuhan, China. *JAMA Neurol*. 2020;77(6):683-690.
13. Singh SJ, Baldwin MM, Daynes E, et al. Respiratory sequelae of COVID-19: pulmonary and extrapulmonary origins, and approaches to clinical care and rehabilitation. *Lancet Respir Med*. 2023;11(8):709-725. doi:10.1016/S2213-2600(23)00159-5.
14. dos Santos Patty K, Sigoli Emilly, Bragança Lorenna JG, et al. The musculoskeletal involvement after mild to moderate COVID-19 infection. *Front Physiol*. 2022;13:813924. doi:10.3389/fphys.2022.813924.
15. Estebanez-Pérez MJ, Pastora-Bernal JM, Martín-Valero R. The effectiveness of a four-week digital physiotherapy intervention to improve functional capacity and adherence to intervention in patients with long COVID-19. *Int J Environ Res Public Health*. 2022;19:9566. doi:10.3390/ijerph19159566.
16. Dubba Naga Raju, Muthukumaran Jothilingam, Dasarapu Indrani. Effect of body weight exercises for COVID-19 survivors. *INTI Journal*. 2023;2023(42):1-5.

In Press