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Original Research Article

Sociodemographic and clinical profile of patients attending a post-COVID-19 rehabilitation program: a multicenter cross-sectional study

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ABSTRACT

Background: Neurological and musculoskeletal manifestations related to COVID-19 are prevalent and can persist beyond 12 weeks, characterizing the "Long COVID". This paper aims to describe the sociodemographic and clinical profile reporting the prevalence of cognitive, emotional and motor symptoms of patients seen at 2 Brazilian-Rehabilitation hospitals.
Methods: Multicentric, descriptive and observational, cross-sectional study, carried out by reviewing the electronic medical records of patients, from March to September 2021.
Results: 611 individuals participated in the study (mean age: 53.4 years), 58.4% were female. Three or more pre-existing comorbidities were reported by 38.6%. Three or more persistent symptoms were present in 77.3%. Neuropsychiatric (65.0%) and memory/attention impairments (55.6%); pain (53.7%) and fatigue (51.6%) were the most prevalent. The majority had the post COVID-19 functional status scale (PCSF) score to ≥2 (66.9%). There was no association between infection severity and reported functional status. Most of the participants did not show risk of fall at Timed Up and Go Test (TUG) (68.6%), and 93.9% presented an average walking speed of ≥ 0.80 m/s. Analyzing the COVID-19 severity and TUG test results, it was identified that severely or critical affected patients had moderate to high risk of fall (P=0,02). There were associations between functional status and gait speed (P=0,01) as well as with the presence of fatigue as a persistent symptom (p=0,03).
Conclusions: The study contributes to the knowledge of sociodemographic and clinical profile of patients who had COVID-19, showing persistent symptoms and the impact of Long-COVID on the individual's function.

Keywords: Long COVID-19, Neurological manifestations, Post COVID-19 rehabilitation

INTRODUCTION

Since the beginning of the new SARS-CoV-2 coronavirus pandemic, studies have identified clinical manifestations in humans, including neurological, as a direct or indirect result of viral action. The most common neurological symptoms in the acute phase of the disease are headache, dizziness, hyposmia and hypogeusia.[1,2] Additionally, neurological syndromes may occur at a lower frequency, but with significant and long-term functional impact, such as stroke, Guillain-Barré syndrome, central nervous system infection, epilepsy, generalized muscle weakness, critical illness polyneuropathy, besides cognitive (memory, planning, and initiative), behavioral, and mood impairment. These neurological conditions require a long rehabilitation period, with an interdisciplinary approach

and lead to greater economic and social impact, given the possibility of permanent disability.[1-5]

Human coronaviruses, including SARS-CoV-2, may be neurotropic.[3] Its conformation and disposition of the surface glycoproteins ("spike" protein) are essential for the entry of the virus into the cell, via angiotensin-converting enzyme type 2 (ACE2) receptor. These receptors are expressed in brainstem neurons and glial cells, raising suspicion of the possible neurotropism of SARS-CoV-2.[1-4]

Joint pain and myalgia have been shown to be common persistent symptoms after SARS-CoV-2 infection.[6] Even among those individuals with mild symptoms, in follow-ups of 30 to 60 days, persistent symptoms involving the musculoskeletal system were reported. Some patients had arthralgia or myalgia that persisted for more than a week, raising the possibility that viral arthralgia is a new manifestation of COVID-19.[7]

Social isolation, which was a measure to control the spread of the disease in several countries, has also been identified as an important factor that negatively impacts on the quality of life and on the level of physical activity of the general population. This factor can also be correlated with the musculoskeletal symptoms reported by this population and with the worsening mental health of individuals who have had COVID-19.[8]

Characterizing the persistent symptoms in patients affected by COVID-19 is important to guide the treatment and rehabilitation strategies that support their functional recovery. Thus, the present study aims to describe the sociodemographic and clinical characteristics of patients attending a post-COVID rehabilitation program at two rehabilitation hospitals in the North East of Brazil.

METHODS

It was a descriptive, observational, cross-sectional study, with sociodemographic and clinical data collected from electronic medical records of patients treated at SARAH-Salvador and SARAH-Fortaleza, two units of SARAH Rehabilitation Network Hospitals at Brazil, in the post-COVID outpatient program, from March to September 2021.

Among the 937 patients admitted during the study period, a specific sample selection was performed for analysis. Of this group, 611 patients (corresponding to 62.5% of the total) were chosen using a method known as "simple random sampling". In this procedure, each patient had the same probability of being selected, ensuring an unbiased representation of the complete population. This random selection was important to allow comprehensive inferences about the epidemiological data (related to the spread and characteristics of the disease in the population) and clinical data (related to health conditions and treatments) of the patients under study. The precision of the estimate was also considered, with a maximum allowable error of 3.0%. Furthermore, the use of a 95% confidence interval ensured that the results obtained in the sample had a high probability of being representative of the results that would be obtained from the total patient population. This method was applied to ensure the reliability, generalizability and representativeness of the study results.

Data were tabulated according to the nature of the variables for statistical analysis. Descriptive analysis was performed for all variables, using absolute and relative frequencies for categorical variables, and measures of position (mean, median and quartiles), dispersion (amplitude and standard deviations) and 95% confidence intervals for continuous variables. To compare the variables, parametric and non-parametric statistical tests were applied. In the case of categorical variables, the chi-square test with or without Yates' correction was used to analyze the proportions between groups.

In addition, Cramer's V was used as a measure of effect size, with a 95% confidence interval.[9] The interpretation for this measure of association is qualitative, so values close to zero indicate little association between the variables, while values close to one indicate a stronger association. Cohen et al, suggests ranges of categories according to degree of freedom. As for the interval variables, the t test was used to compare means, and as a measure of the size of the effect, Cohen's d coefficient was used, also with a confidence interval of 95%. A significance level of 0.05 was adopted to consider a statistically significant result. All analyzes were performed using SPSS software version 21 and the R package version 4.2.3 (R Core Team, 2023).

Patients that had clinical and laboratory diagnosis (association between flu syndrome and specific laboratory tests in the acute phase of the disease) or presumptive COVID-19 (self-report of flu syndrome without information about specific laboratory tests in the acute phase of the disease) with persistent manifestations related to COVID-19 were selected for analysis.

We sought to portray the prevalence of complications and neurological symptoms associated with COVID-19, as well as the main cognitive, emotional and musculoskeletal symptoms identified in the admission assessment to the rehabilitation program.

The hospitals involved in the study are part of a network dedicated to the rehabilitation of patients with neurological diseases, but they have no emergency services nor intensive care units. Most patients were initially treated at other health units specialized in acute care, such as community health units or other public and private hospitals. Aspects related to the presentation and severity of COVID-19 in its acute phase were collected from anamnesis and medical reports, when available.

According to the World Health Organization (WHO) classification, patients were categorized into mild, moderate, severe and critical COVID-19.[10]

Regarding the assessment of functional status, the post-COVID-19 functional status scale was used (post-COVID-19 functional status scale-PCFS). The scale was presented to the individuals and together with the physiotherapist and/or nurse, the graduation was performed. The risk of fall was quantified using the test timed up and go (TUG). The test was performed using a chair with armrests and a stopwatch. The time taken for the seated individual to get up, walk a distance of 3 meters and return to the chair, sitting down again, was quantified. Individuals who took 20 seconds or more to complete the test were classified as at high risk of fall.[12]

Gait speed was evaluated through the 10-meter walk test (10MWT) with the patient covering a distance of 14 meters, measuring time spent walking the central 10 meters, grading the speed in meters per second. The speed of 0,8 m/s was used as a cutoff point to indirectly classify individuals as community walkers or not.[13]

Hand grip strength was measured using a hydraulic hand dynamometer (Jamar, hydraulic model, Saehan, reference SH 5001) and values below 19 kg and 32 kg were considered predictive of sarcopenia for women and men, respectively.[14]

The study was approved by the Sarah Network Research Ethics Committee (CAAE: 58247922.5.0000.0022).

RESULTS

During the period from March to September 2021, 937 patients were seen at the post-COVID-19 rehabilitation program at two rehabilitation hospitals in the north-east of Brazil. The final study sample consisted of 611 individuals.

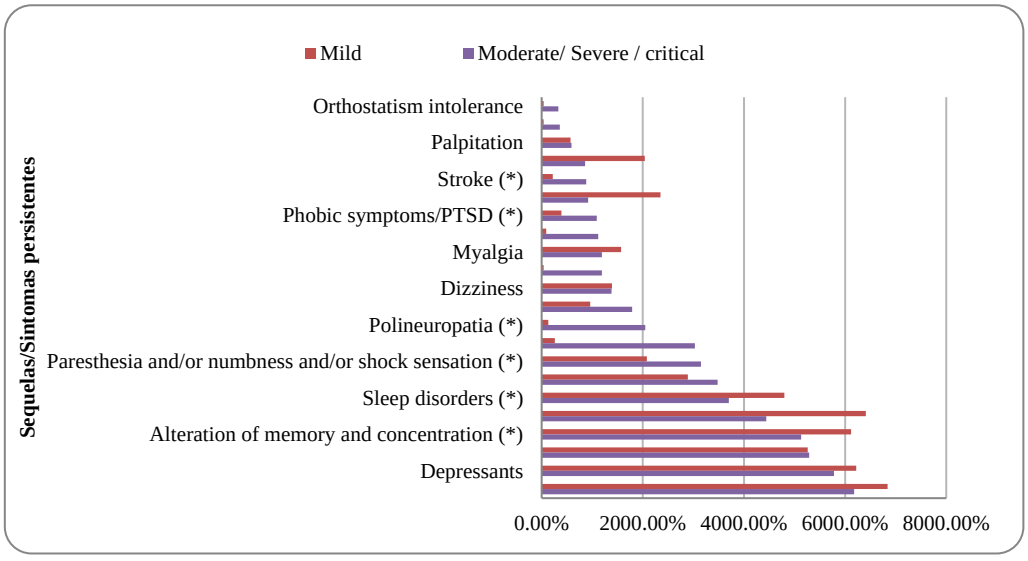

Figure 1: Prevalence of persistent symptoms and sequelae with severity of COVID-19.

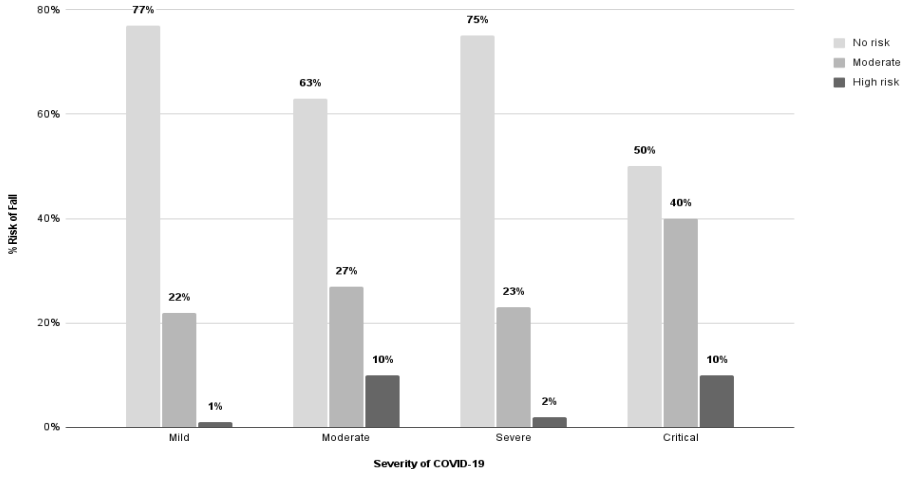

Figure 2: Risk of fall (TUG) and severity of COVID-19 (p=0.02).

The majority of these participants were female (58.4%), married (49.6%), with a level of education equal to or higher than high school (78.1%), from capital cities (Salvador and Fortaleza – 82.8%), with a mean age of 53.4 years (14.0) in the 95% confidence interval between 52.3 and 54.5 years.

Regarding the diagnostic criteria for acute SARS-CoV-2 infection, 535 patients had laboratory tests, of which 38 serological tests and 379 virological tests (antigenic test n=78 and RT-PCR n= 301). A smaller number of patients were unable to provide details regarding their tests (n= 118).

Most patients had at least one clinical comorbidity (n = 505; 82.7%), being that 236 patients (38.6%) reported three or more comorbidities. Systemic arterial hypertension (57.6%), dyslipidemia (42.0%), obesity/overweight (36.8%), diabetes mellitus (33.7%) and previous psychiatric conditions (21.2%) were the most reported comorbidities in that population (Table 2).

Regarding the severity of COVID-19 in its acute phase, it was possible to classify the presentation of the disease in 539 of the participants. The mild COVID-19 form was more prevalent (43.0%), followed by severe and critical forms (19.5% and 19.5%, respectively) (Table 2).

During the acute phase of COVID-19, complications were reported in 177 (29.0%) patients. Among the reported acute complications, neurological, thrombotic and cardiac manifestations were the most noted (Table 2).

In the group of individuals who had manifested moderate, severe or critical forms of COVID-19, 48.2% presented more than 3 comorbidities, with diabetes mellitus, dyslipidemia, obesity/overweight being the most prevalent in that population (p<0,001; V=0.21 95%CI (0.13–0.29); effect size classification: small). Among patients with mild forms of the infection, there was a higher prevalence of previous psychiatric conditions (p=0,04; V=0.10 95% CI (0.01–0.20)); classification of effect size: small).

Three or more persistent symptoms were reported in 77.3% of participants. Among the main persistent symptoms, neuropsychiatric issues (65%), memory and attention impairments (55.6%), pain (53.7%), fatigue (51.6%) and paresthesias/numbness (27.0 %) prevailed. Smell (14.3%) and taste impairments (12.6%) were also prevalent symptoms. Among the persistent sequelae, stroke (5.4%) and neuromuscular disease (18.3%) can be highlighted. It is worth mentioning the presence of heterotopic ossification in 0.3% (Table 3).

Among mild COVID-19 patients, smell and taste impairments, memory and attention issues, sleep disturbances and osteoarticular pain were more prevalent symptoms (p<0,05, small effect size) when compared to the other forms of acute presentation.

In the groups with moderate, severe and critical acute conditions, a higher frequency of phobic symptoms and post-traumatic stress disorder, paresthesias, intolerance to orthostatism and exercise intolerance were observed. Sequelae related to stroke and to neuromuscular disease were also more prevalent in these forms of disease presentation (p<0,05).

A Figure 1 shows the association between persistent symptoms and reported sequelae with severity of COVID-19 in the acute phase.

Most of patients with persistent neuropsychiatric symptoms were female (66.4%) (p<0.001, V=0.22 (0.14–0.30)) and among the associated complaints prevailed fatigue (p<0.001, V=0.21 (0.14-0.28)), memory and attention issues (p<0.001, V=0.39 (0.31–0.46)), myalgia (p=0,02, v=0.10 (0.03–0.17)), smell (p=0,03, V=0.09 (0.02–0.17)) and taste impairments (p=0,01, V=0.11 (0.04–0.19)). palpitation (p=0,002, V=0.13 (0.06–0.18)) and dizziness (p=0,02, V=0.10 (0.03 –0.17)). The magnitude of the effect was considered medium for memory alteration and small for the other evaluations.

Regarding the functionality, the PCSF scale was applied to 236 participants. Mild functional impact (grade 2) was reported by 40.7%, while 10.2% reported the absence of functional impact (grade 0). Only 7.2% reported severe functional impact (grade 4). Stratifying functional impact referred to on the PCSF scale and severity of the COVID-19 infection, it is observed that 78.2% (68) of the individuals who presented mild COVID-19 had mild to very mild functional impact, or no limitations.

Among individuals who had severe or critical COVID-19 (n = 85), 29.4% (n=25) reported moderate or severe limitations (PCSF grade 3 and 4) and 11.8% (n = 10) mentioned no functional impact (PCSF grade 0). No association was observed between infection severity and functional status (X2 (9) = 9.2, p = 0,42). Regarding main persistent symptoms, no association was observed between three or more persistent symptoms and post-COVID-19 functional impact scale level (PCSF) (X2 (3)=1.3, p=0.74). With reference to functional mobility tests, 210 participants performed the TUG test and 230 performed the 10-meter walk speed test. TUG test scores revealed that 68.6% (144) of the participants were not at risk of fall and that 93.9% (216) had an average speed equal to or greater than 0.80 m/s (Table 4).

When analyzing the severity of COVID-19 with TUG test scores, it was possible to identify that patients who had suffered from severe or critical conditions presented moderate or high risk of fall in the test when admitted to the rehabilitation program (p=0,02, V=0.22 (0.12–0.39)), small effect size) (Figure 2).

In total 84 men and 123 women had their handgrip strength measured. Among men, 54.8% (46) showed strength below 32 Kgf in the right hand, and association

between this deficit and the severity of the infection in the acute phase was observed (p=0.047). Among women, 62.9% (86) had impaired handgrip strength (below 19 kgf), however no association was observed with the severity of the infection presented (p=0.141). Table 4 details the results of the main functional tests applied.

Table 1: Sample description.

	Frequency	%
Gender		
Masculine	254	41,6
Feminine	357	58,4
Education		
Illiterate	8	1,3
Elementary School	126	20,6
High school	233	38,1
University education	244	40
Civil status		
Single	204	33,4
Married	303	49,6
Stable union	6	1
Divorced	53	8,7
Widower	40	6,5
No information	5	0,8
Origin		
Capital	506	82,8
Metropolitan region	51	8,3
Counterside	49	8
Other states	5	0,8
Confirmatory test performed for COVID-19		
Not Reported	59	9,7
No	17	2,8
Yes	535	87,6
RT-PCR	301	56,3
Antigen	78	14,6
Rapid test (serological)	38	7,1
Not reported	118	22,1
Number of comorbidities		
No	106	17,3
Yes	505	82,7
1	124	24,5
2	145	28,7
3	111	22
4	78	15,4
5	33	6,5
6	10	2
7	4	0,8
Number of complications		
No	434	71
Yes	177	29
1	122	68,9
2	39	22
3	14	8
4	2	1,1
Number of persistent symptoms		
No	0	0
Yes	611	100
1	59	9,7
2	80	13,1
3	102	16,7
4	96	15,7
5	99	16,2
6	72	11,8

Continued.

	Frequency	%
7	49	8,0
8	29	4,7
9	13	2,1
10	10	1,6
11	2	0,3

Age (years): Average [95% confidence interval) 53,4 (52,3-54,5).

Table 2: Health status: severity of COVID-19, pre-existing comorbidities and complications of COVID-19.

Severity of COVID-19	Frequency	%
Not classified	72	11,8
Classified	539	88,2
Mild	232	43,0
Moderate	97	18,0
Severe	105	19,5
Critical	105	19,5
Comorbidities		
No	106	17,3
Yes	505	82,6
Asthma and/or other lung diseases	39	7,7
Previous psychiatric conditions	107	21,2
Dementia	13	2,6
Diabetes mellitus	170	33,7
Dyslipidemia	212	42,0
Heart diseases	65	12,9
Liver diseases	15	3,0
Systemic arterial hypertension	291	57,6
Immunosuppression including neoplasms	15	3,0
Renal insufficiency	10	2,0
Obesity and/or overweight	186	36,8
Others	189	37,4
Complications		
No	434	71,0
Yes	177	29,0
Thrombotic	48	27,1
Pulmonary embolism	22	12,4
Deep vein thrombosis (DVT)	34	19,2
Cardiac	15	8,5
Arrhythmias	11	6,2
Myocardial infarction	2	1,1
Myocarditis	3	1,7
Neurological	51	28,8
Stroke	25	28,8
Seizures	16	17,7
Encephalopathy	18	19,9
Guillain Barre syndrome	1	0,6
Other complications	118	66,7

Table 3: Incidence of persistent sequelae/symptoms.

Persistent sequelae/symptoms	Frequency	%	Cases
Sequelae			
Stroke	33	5.4	609
Neuromuscular disease	112	18.3	611
Peripheral nerve injury	40	6.6	605
Plexopathy	13	2.1	606

Continued.

Persistent sequelae/symptoms	Frequency	%	Cases
Polineuropatia	74	12.3	603
Myopathy	40	6.6	605
Heterotopic ossification	2	0.3	607
Neuropsychiatric symptoms	396	65.0	609
Sleep disorders	254	41.9	606
Depression	362	59.5	608
Phobic symptoms/PTSD	42	6.9	605
Fatigue\Pain	199	32.6	611
Pain	325	53.7	605
Fatigue	314	51.6	608
Memory and attention issues	334	55.6	601
Smell changes	83	14.3	582
Taste changes	73	12.6	581
Exercise intolerance	84	13.9	603
Intolerance to orthostatism	11	1.8	602
Myalgia	82	13.6	604
Palpitations	37	6.1	605
Paresthesia and/or numbness and/or shock sensation	164	27.0	607
Dizziness	79	13.0	606
Other symptoms	204	33.6	608

Table 4. Functional aspects (functional test results).

Post-COVID-19 functional status scale (PCSF)	Frequency	%
No	375	61.4
Yes	236	38.6
0	24	10.2
1	54	22.9
2	96	40.7
3	45	19.1
4	17	7.2
Curfew risk (TUG)		
No	401	65.6
Yes	210	34.4
No risk of fall	144	68.6
moderate risk of fall	55	25.2
high risk of fall	11	5.2
Speed test		
No	381	62.4
Yes	230	37.6
Speed below 0.8 cm/second	14	6.1
Speed equal to or greater than 0.8 cm/second	216	93.9
Hand grip strength (male gender)		
No	170	33.1
Yes	84	66.9
Below 32 Kg	46	54.8
Equal to or greater than 32 Kg	38	45.2
Hand grip strength (female gender)		
No	234	34.4
Yes	123	65.5
Below 19 Kg	86	62.9
Equal to or greater than 19 Kg	37	30.1

DISCUSSION

Post-COVID-19 or long COVID syndrome includes a large number of physical and mental symptoms developed during or after the acute phase of COVID-19 that persisted longer than or equal to 2 months, with impact on the patient's life not explained by another diagnosis.[15] It is believed that several factors may be

related to this syndrome, including viral persistence, inflammatory changes, physical deconditioning and psycho-emotional factors.[16] According to the literature, even in patients with mild presentation of the disease, there may be a lasting impairment in their physical, cognitive, mental and social health, directly interfering in their daily lives.[16]

In the study conducted by Braga et al, all participants complained of memory issues after COVID-19 and presented neuropsychological performance below the reference values in all subscales and general scores of the BNIS (barrow neurological institute screen for higher cerebral functions) as well as verbal fluency tests. Nearly half of the sample also made at least two errors on the clock drawing test. It is noteworthy that the performance in the tests did not correlate with the severity of COVID-19 in the acute phase.[17] The actual prevalence of long COVID is unknown. A meta-analysis of 54 studies and two medical records databases from 22 countries estimated that between March 2020 and January 2022, in three months, 6.2% of individuals who had had symptomatic COVID-19 infection experienced at least a complaint such as: persistent fatigue with myalgia or mood changes (3.2%), cognitive impairment (2.2%) or persistent respiratory sequelae (3.7%).[18]

In the present study, the average age was 53.4 years and most patients were female (58.4%). A global study noted that women aged 20 and over were more likely to have long symptoms of COVID-19 than men (10.6% versus 5.4%).[18] A retrospective study used a database to determine persistent symptoms in non-hospitalized adults and the risk factors associated with the development of these symptoms, compared to a cohort of patients without SARS-CoV-2 infection. Among the cohort of patients infected with SARS-CoV-2, risk factors for long COVID included: female gender, belonging to an ethnic minority, socioeconomic deprivation, smoking, obesity, and the presence of comorbidities.[19] Peñas et al, found that the risk of women developing persistent symptoms was 2.25 times greater than that of men. In addition, being female was a risk factor for development of persistent symptoms, such as fatigue, dyspnea, pain, hair loss, sleep disorders, and psychiatric symptoms such as depression.[20]

A case series of 214 patients hospitalized with COVID-19 in Wuhan, China, in January and February 2020, reported that 78 (36.4%) patients had at least one neurological manifestation.21 In the current study, three or more persistent symptoms were reported in 77.3%. (Table 1). Among the main persistent symptoms, neuropsychiatric impairment prevailed (65%), as well as memory and attention issues (55.6%), pain (53.7%), fatigue (51.6%) and paresthesia/numbness (27%). Smell (14,3%) and taste impairments (12.6%) were also prevalent symptoms (Table 3).

Other observational studies described that at least one-third of patients after acute COVID had more than one persistent symptom, such as fatigue (13 to 87%), dyspnea (10 to 71%), chest pain or tightness (12 to 44%) and cough (17 to 34%). Less common persistent physical symptoms included anosmia, arthralgias, headache, sicca syndrome, rhinitis, dysgeusia, lack of appetite, dizziness, myalgias, insomnia, hoarseness, alopecia, sweating, decreased libido and diarrhea.[6,22,23] In a meta-analysis published in 2021, Leon et al, estimated that up to 80% of patients infected with SARS-CoV-2 developed one or more persistent symptoms.[24]

A study with 100 acute COVID-19 patients who were discharged from the hospital, post-traumatic stress disorder was reported by 24%, while 18% presented new or worsening memory complaints and 16% had attention issues. Figures were higher among patients admitted to intensive care units (ICU).[25] Another study that evaluated ICU survivors reported that 23% presented anxiety, 18% depression and 7% post-traumatic symptoms.[26] However, other authors did not find significant differences in anxiety and depression scores between hospitalized and non-hospitalized patients.[17] Our study observed higher frequency of phobic symptoms and post-traumatic stress, paresthesias, intolerance to orthostatism and intolerance to exercise in the group with moderate, severe and critical acute conditions.

It is known that the etiology of neuropsychiatric symptoms in patients with COVID-19 is complex and multifactorial. It may be related to the direct effect of the infection, cerebrovascular disease, physiological impairment due to cerebral hypoxia, medication side effects, social aspects, isolation and risk of disease lethality. Individuals with previous psychiatric conditions may have a potential state of vulnerability and risk of cognitive/emotional worsening after COVID-19, as observed in our population.[27]

In this study, sequelae related to stroke occurred in 5.4% and neuromuscular disease in 18.3%. These conditions were observed with greater prevalence among patients with moderate, severe or critical forms of COVID-19 in the acute phase. Taquet et al observed that neurological issues, including stroke, parkinsonism, Guillain Barré syndrome, neuromuscular disease, encephalitis, and dementia, were higher in patients with severe COVID-19 than in those with mild disease, in which psychiatric disorders were most frequent (mood disorder, anxiety disorder, substance abuse disorder and insomnia).[28] These psychiatric disorders may have been driven more by general effects, including psychosocial aspects of the infection, rather than a direct effect of COVID-19 on the brain.

Pain was another frequently mentioned symptom in our sample (53.7%). This is yet another symptom of multifactorial etiology, whose psycho-emotional aspects directly interfere with its qualification.[29]

The post-COVID-19 syndrome represents an intricate multisystem disease associated with physical and mental health sequelae, with a significant impact on people's well-being and quality of life.[16,30] The measurement of functional capacity through functional tests is relevant and provides an essential perspective of the functional status of individuals, directing the correct treatment and resources necessary for their rehabilitation, in addition to reflecting the limits to carry out daily activities.[31]

The PCFS evaluates and stratifies the functional impairment in the individual's daily life through their self-perception. The scale helps to identify symptoms that impact on usual activities and the level of disability the individual is facing. However, there is a lack of evidence documenting the functional status after COVID recovery, with an imminent need for further research to consolidate such functional limitations in the medium and long term, post-viral contamination.[31]

Most participants in the present study reported mild functional impact on the PCSF scale. Although most of these individuals presented mild COVID-19, an association between infection severity and functional status on the PCFS scale was not observed in our population. Similarly, the authors Menezes et al, and Bahmer et al, found in their cross-sectional studies that different levels of severity of the disease may be associated with persistent symptoms of long COVID, highlighting the heterogeneity of this condition.[32,33]

A British study with patients who presented COVID-19 without the need for hospitalization, therefore assuming mild conditions, showed that not only clinical factors, but also socio demographic aspects, were among the risk factors for the persistence of symptoms.[19] As in our study, the authors found that young women were more likely to develop long COVID. Likewise, no association was observed between the number of persistent symptoms and the intensity of the functional impact reported in the PCSF scale. However, it is worth highlighting that our study did not aim to assess the intensity of each persistent symptom. The intensity of the symptoms might be more important than the number of symptoms in the genesis of the functional impact. Yet, the authors point out the association between impairment in the objective functional assessment through motor tests with either severity of COVID-19 and the post-infection functional status (PCSF) found in the present study. Patients with a history of severe or critical COVID-19 had a moderate to high risk of falls quantified by the TUG test and reduced handgrip strength in men. Additionally, the reporting of more compromised functional status in the PCFS was associated with reduced gait speed through the 10MWT.

Most participants did not show impact on mobility, noting that the majority manifested the mild form of the disease. Guzik et al carried out a study with 50 people who recovered from mild COVID-19 (study group) and 50 healthy individuals (control group) matched for sex and age. They identified worse performance in the study group compared to the control group in the following mobility assessment: TUG, the 15-second step test, the 5-times sit-to-stand test and the 6-minute walk test, with statistically significant difference ($p \leq 0.05$).[30] In the present study, there was a prevalence of a history of severe or critical forms of the infection among those who showed mobility impairment.

Ibarra et al, performed a literature review and concluded that systemic inflammation caused by SARS-CoV-2 combined with physical inactivity and the poor nutritional status, common to critically ill patients, can act in a severely deleterious way on muscle health. The authors pointed out that these issues lead not only to loss of lean mass, but also pain and functional impairment.[34] It is known that handgrip strength is a valuable predictor of sarcopenia.[14] In our male population, an association was observed between reduced grip strength and disease severity. On the other hand, in the female population, no such association was observed, highlighting the fact that 70% of this group showed compromised grip strength in the test.

Fatigue is a persistent symptom that is quite frequent after the acute phase of COVID-19. In our population, an association was observed between this symptom and reduced gait speed to ≤0.80 m/s, which is considered not safe for walking in the community. The influence that fatigue seems to have on gait speed may be an important factor behind the low quality of life, social reintegration and return to work, present among people with long COVID.[35-37] Pre-infection conditions also appear to play an important role in the resolution of persistent symptoms despite treatment, indicating the biopsychosocial character of the syndrome.[38] It might be the main challenge in the rehabilitation of those affected by that condition.

Our study evaluated the motor and functional repercussions throughout specific outcome measurements, while did not evaluate the perception of quality of life (QoL). However, it is important to highlight that physical impairment after COVID-19 has been seen as an important factor that negatively impacts QoL in that population.[38-40]

Limitations

Despite the significant sample size, since it was an observational study based on symptoms reported by patients and a control group was not adopted, it is not possible to make inferences. For instance, if the persistent symptoms were due to direct SARS-CoV-2 infection, pre-existing comorbidities or psycho-emotional effects related to the social isolation imposed by the pandemic. A second limitation was data loss, considering that the study was based on data collection from medical records and some information was not found. As an example,

only about half of the sample had functional assessment data in their medical records.

CONCLUSION

The characterization of sociodemographic and clinical profile of patients who had COVID-19 and presented persistent symptoms on cognition, emotion, mobility and functionality related to long COVID is the first step to structuring a multidisciplinary approach and optimize the rehabilitation plan. Despite the vaccine coverage, which had an impact on the reduction of severe forms of COVID-19, it is necessary to understand that also mild infections can lead to post-COVID syndrome. Early recognition of the symptoms of long COVID-19 may contribute to reducing complications and improving the quality of life of these individuals.

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