ORIGINAL ARTICLE

Received: Jul 17, 2023

Revised: Feb 19, 2024

Approved: Mar 14, 2024

Post-traumatic stress disorder in individuals who required hospitalization for COVID-19: A cross-sectional study

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Declaration of interests: None to declare.

Funding: FACEPE **(**APQ-0182-4.08/20)

ABSTRACT

Introduction: Currently, the physical and functional consequences on individuals who have recovered from the severe form of the Covid-19 and are experiencing traumatic stress remain unknown. **Objective:** To assess post-traumatic stress disorder (PTSD) in individuals post-hospital discharge following COVID-19 and investigate its relationship with sociodemographic variables, quality of life, muscle strength and functional capacity. **Methods:** A cross-sectional study was conducted, including individuals of both genders aged between 31 and 79 years, who had recovered from COVID-19 and required hospitalization. Participants underwent evaluations for PTSD, physical activity level, mobility and balance (Timed Up and Go test – TUG), the distance covered in the 6-minute walk test (6MWT) and quality of life (Short Form-36 Health Survey -SF-36). **Results:** Out of 153 eligible individuals, 60 successfully completed the assessments. The age range was 31 to 77 years, and 63.3% were female. PTSD was identified in 48.3%, with 38.7% exhibiting partial symptoms. Furthermore, 65.5% of individuals with PTSD were obese, and 62.1% were hypertensive. This group demonstrated a higher degree of sedentary behavior ($p=0.009$), increased frequency of intensive care unit hospitalization, and a greater number of days hospitalized, respectively ($p<0.001$ and $p=0.010$). They exhibited longer times in the TUG ($p=0.014$), shorter distances than predicted in the 6MWT ($p=0.001$), and a reduction in all domains of the SF-36. **Conclusion:** Given the findings of this study, the follow-up of these individuals needs to be continued in order to verify the permanence of these symptoms and functional manifestations.

Keywords: stress disorders, post-traumatic; COVID-19; mental disorders; comorbidity; quality of life; hospitalization.

INTRODUCTION

With the exponential increase of Covid-19 in mid-March 2020, the spread of news about contagion forms, disease severity and the need for social isolation as mitigation efforts led to emotional impacts which became more evident with its spread[1].

COVID-19 triggers inflammation in both the body and the brain, giving rise to psychiatric symptoms, particularly in individuals who have been discharged from the hospital after experiencing a significant level of emotional stress due to confinement within the hospital setting and the impact of the disease itself[2]. Social distancing and social isolation measures[3] have led patients being more prone to anxiety symptoms, depressive disorders and insomnia, resulting in the occurrence of post-traumatic stress disorder (PTSD)[2]. PTSD is a persistent and intense experience of traumatic memories, psychological and physiological suffering, symbolizing aspects of the traumatic event, continuous symptoms of increased excitability and occupational impairment in several important areas of their life[4].

According to previous evidence, individuals with COVID-19 manifest psychiatric symptoms that persist or become present months after the initial infection[5]. In a study carried out in Italy, about 56% of COVID-19 survivors had at least one of the domains evaluated for psychiatric sequelae (PTSD, depression, anxiety, insomnia and obsessive-compulsive symptomatology) after one month of hospitalization[6].

Patients who required hospitalization witnessed traumatic events during their hospitalization, such as sudden deterioration from the disease, emergency resuscitation procedures, or even death[7]. Situations of this nature can trigger PTSD, which is manifested by a set of emotional and behavioral reactions[8].

https://doi.org/10.7322/abcshs.2023158.2451

At the time of this study, no literature findings were available regarding the impact of Covid-19 on the occurrence of PTSD, quality of life, muscle strength, or functional capacity among patients who had required hospitalization. Corral et al.[9] elucidated the effects of symptoms, encompassing dyspnea, fatigue/muscle weakness, PTSD, anxiety, and depression in patients who had recovered from Covid-19 without hospitalization, revealing impairment across all the aforementioned outcomes.

Therefore, it is imperative to investigate the occurrence of analogous manifestations in patients who have recovered from moderate to severe Covid-19 and underwent hospitalization.

Thus, this study aimed to evaluate the presence of PTSD in individuals who required hospitalization for COVID-19 and its relationship with sociodemographic variables, quality of life, muscle strength and functional capacity.

METHODS

Participants

Individuals of both genders aged between 31 and 79 years, clinically recovered from COVID-19 (diagnosis confirmed by positive RT-PCR test or positive IgG serology for COVID-19), and who required admission to the ICU or ward of public or private hospitals were invited to participate in this study. Individuals who presented musculoskeletal alterations that prevented the performance of functional tests and cognitive alterations that made it difficult to understand the applied questionnaires were excluded. Participants were evaluated 120 days after hospital discharge.

https://doi.org/10.7322/abcshs.2023158.2451

Procedure

Study design

This is a cross-sectional study developed at the Laboratory of Cardiopulmonary Physical Therapy of the Federal University of Pernambuco from May 2021 to April 2022. The present study was approved by the institutional ethics committee (number 4,666,479) in accordance with Resolution 466/12 of the National Health Council. Study participants were recruited through dissemination on social media and by indication of health professionals during the study period.

Measures

The individuals initially had their sociodemographic (age, gender, marital status and nationality), symptoms (fever, asthenia, anosmia, dyspnea, headache and dizziness), weight (kg), height (meters) and body mass index (BMI), length of stay in the ward or ICU (days), use of invasive mechanical ventilation (yes/no) and time (days), or time of oxygen therapy support (days) and presence of previous comorbidities data collected.

The patients were subsequently evaluated for: PTSD (event impact scale – revised (IES-R), physical activity level (IPAQ), body composition, maximal inspiratory (MIP) and expiratory pressure (MEP) muscle strength, hand grip (dynamometry), mobility and balance (Timed Up and Go test), quadriceps muscle thickness of the dominant lower limb (muscle ultrasound), the distance covered in the 6-minute walk test (6MWT) and quality of life (SF) -36), all evaluations were performed by a single evaluator.

https://doi.org/10.7322/abcshs.2023158.2451

Post-traumatic stress disorder

The event impact scale – revised (IES-R) translated into Portuguese was applied to assess post-traumatic stress disorder[10]. This scale is self-administered, composed of 22 items distributed in 3 subscales (avoidance, intrusion and hyperstimulation) that include the evaluation criteria for post-traumatic stress disorder published in the 4th edition of the American Diagnostic Classification (DSM-IV) of the American Psychiatric Association. The individuals responded based on the pre-defined stressor event "hospitalization period".

The score for each question ranges from 0 to 4 points. Responses are scored on a Likert scale, and their total score ranges from 0 to 88 points. A score > 24 indicates the presence of partial symptoms of PTSD[11] and ≥ 33, a probable diagnosis for PTSD[12].

Physical activity level

Physical activity level was verified using the short version of the International Physical Activity Questionnaire (IPAQ). This questionnaire consists of 8 open questions about the time and frequency of activities performed in the last week, and assesses the time spent per week in physical activities. The questionnaire classifies the physical activity level into "sedentary", "irregularly active A and B", "active" and "very active"[13]; however, the classification of patients for this study were considered as "active" (very active and active categories) and "sedentary" (irregularly active and sedentary categories)[14].

https://doi.org/10.7322/abcshs.2023158.2451

Body composition

Body composition was analyzed using body bioimpedance (InBody R20, Dogok 2-Dong, Gangnam-Gu, Seoul, South Korea). The individual was instructed to wear light clothes, and empty their bladder before the examination. The patient remained in an orthostatic position during the test with their feet positioned on the electrodes on the surface of the digital scale and the other electrodes attached to a bar held by their hands. The bioimpedance lasted 30 seconds and was repeated in case of a reading error[15]. Body weight (Kg), body mass index (BMI, Kg/m^2), lean mass (Kg) and the calculated lean mass index (lean mass divided by height squared) were obtained [Kg/m^2]).

Respiratory muscle strength

Individuals were instructed to perform a maximum inspiratory effort from the residual volume to measure maximal inspiratory pressure (MIP) (Global Med MVD300-U, Brazil), and then they were instructed to perform a maximum expiratory effort from their total lung capacity to determine maximal expiratory pressure (MEP). The greatest negative pressure sustained for at least one second was recorded. At least three reproducible maneuvers were repeated, with variability <10 cmH_2O between measurements, and a one-minute rest between them[16]. The predicted values were calculated according to the study by Neder et al.[17], and the predicted percentage was then calculated.

Handgrip strength

The handgrip strength measurement was performed on the dominant upper limb with the patient seated (Dinamometer Smedley-Typehand, Saehan, South Korea).

https://doi.org/10.7322/abcshs.2023158.2451

Patients performed three attempts with an interval of 30s between each execution and the highest value obtained between the maneuvers was recorded; the highest value reached for the dominant limb was considered as long as the measurements differed below 10%[18].

Next, the equation proposed by Novaes et al.[19] was used to determine the predicted value for each patient. The present study classified handgrip strength as low for values <32 kg for men and <17 kg for women, based on the 20th percentile of the sample[20].

Timed Up and Go (TUG) test

Patients performed the TUG test according to the instructions provided, being classified as totally free and independent for time <10 seconds and independent, with time between 10 and 19 seconds. The examiner accompanied the patient for their safety[21].

Quadriceps muscle thickness

Quadriceps muscle thickness was measured using a portable high-definition ultrasound device using B-mode images (Sonoace R3, SamgungMedison, South Korea), with a linear type transducer and a frequency of 10Mhz. The transducer was positioned perpendicularly on the anterior thigh region of the dominant lower limb, viewing the cross-sectional image of the quadriceps muscle. Thus, three thickness measurements of each portion of the quadriceps femoris were performed: the vastus intermedius (VI) and the rectus femoris (RF), in millimeters, from the frozen image. The means of the 3 values obtained were <10% difference between measurements[22].

https://doi.org/10.7322/abcshs.2023158.2451

The 6-minute walking test

The 6MWT was performed according to the guidelines established by the American Thoracic Society[23]. The predicted distance was based on the study by Britto et al.[24] and then the predicted percentage in relation to the expected for each patient was calculated.

Quality of life

A questionnaire consisting of 36 items was applied for the quality of life assessment and subdivided into 8 domains called: "functional capacity" (FC), "physical aspects", "pain", "general health status", "vitality", "social aspects", "emotional aspects" (EA), and "mental health" (MH)[25]. The values for each domain were corrected and scored according to Simionato et al.[26]. The results were evaluated by assigning scores to each question, which were transformed into a scale from zero to 100, where zero corresponded to a worse quality of life and 100 to a better quality of life. Each domain was analyzed separately[27].

Data analysis

Data normality distribution was initially verified using the Kolmogorov-Smirnov test. Data were presented using central tendency and dispersion measures. The association was verified by Pearson's Chi-Squared Test and/or Fisher's Exact Test. Comparisons between the group with and without PTSD were performed using the Student's t-test or the Mann-Whitney test. All tests were applied with 95% confidence. The analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 13.0 for Windows.

https://doi.org/10.7322/abcshs.2023158.2451

RESULTS

Of the 153 individuals initially eligible for the study, 60 completed the assessments, as can be seen in Figure 1.

The age group ranged from 31 to 77 years (median 54.40) and 63.3% of the individuals evaluated were female. PTSD was found in 48.3%; however, 38.7% of individuals without PTSD presented criteria for the development of partial symptoms when the cut-off point > 24 was used. Among the main comorbidities in individuals with PTSD, 65.5% were obese and 62.1% were hypertensive. Fatigue and fever (93.1%), ageusia, anosmia and cough (82.4%), asthenia and headache (79.3%), and dizziness and nausea (72.4%) symptoms were the most frequent among them. The other characteristics are described in Table 1.

Table 2 demonstrates that individuals who had PTSD had a moderate risk of falling, lower performance on the 6-minute walk test, and reduced respiratory muscle strength compared to the group without PTSD.

Individuals with PTSD exhibited a detriment in terms of quality of life, as illustrated in Figure 2. The domains associated with "physical aspects" (31.45±26.77 and 52.16±37.47, $p<0.005$, respectively) and "emotional limitations" (31.47±23.80 and 52.16±69.04, $p<0.005$, respectively) notably demonstrated significantly lower scores.

DISCUSSION

The presence of PTSD in individuals who had severe and moderate COVID-19 was 48.3%; however, 38.7% of individuals without symptoms began to present criteria to develop partial symptoms for PTSD when the lowest cut-off point was considered.

https://doi.org/10.7322/abcshs.2023158.2451

All the individuals evaluated in our study had the moderate and severe form of COVID-19 and required hospitalization in a hospital ward or in the ICU. The presence of PTSD after hospitalization for COVID-19 may be due to their experience in the context of hospitalization during the pandemic, in which they needed to be isolated in a hospital bed, they experienced the physical impacts of the disease, exposure to invasive procedures and had a constant fear of death[2].

In a cohort developed by Vlake et al.[28], it was found that the presence of PTSD in the first month after hospitalization for Covid-19 dropped from 16% to 7% at the end of the third month. The difference between the study by Vlake et al.[28] and ours may be related to the presence of different ethnicities (Asian, African, unknown and others) and the follow-up time of these individuals after discharge in the latter study. Our results point to PTSD persisting even after the fourth month of hospital discharge when data began to be computed.

Individuals who presented PTSD were characterized as being more sedentary, having required hospitalization in the ICU and spending more days in the hospital. This may be associated with the use of sedative medications during the hospitalization period in the ICU[29], generating an increase in traumatic delusional memories and high rates of PTSD[30]. A sedentary lifestyle was considered a risk factor for the severe form of the disease in a study by Hamer et al.[31].

From a functional point of view, individuals with PTSD who participated in the study had a moderate risk of falling, took longer to perform the TUG, had lower performance on the walking test and reduced muscle strength, as in the studies by Guler et al.[32] and Huang et al.[33]. These authors associated the severe phenotype of COVID-19 and found a longer hospital stay among those who had a worse prognosis for recovery[34],

https://doi.org/10.7322/abcshs.2023158.2451

thus justifying the performance in this test. The individuals with PTSD in our study also had worse functional performance and longer ICU stays, which may have contributed to this behavior. The lower functional performance on the walking test was also found in the study by Gloeckl et al.[35], who found a shorter distance covered in the test in patients who had the most severe form of the disease.

Respiratory muscle strength was also below the predicted values for the evaluated individuals, especially for those who had PTSD. These results coincide with a higher frequency of ICU admission, a greater number of days hospitalized and the presence of a sedentary lifestyle among these individuals. These factors, associated with the use of corticosteroids, sedatives and/or neuromuscular blockers[36,37] and mechanical ventilation, may have contributed to clinical deterioration and repercussions on the emotional state and permanent sequelae of these individuals[29,37].

According to our results regarding quality of life, individuals with PTSD had lower scores than those without it, which is similar to the study by Becerra-Canales et al.[38]. According to these authors, a direct relationship between quality of life and PTSD can be verified[38]. The impact of the disease on quality of life during coronavirus outbreaks (MERS, SARS and COVID-19) can be attributed to changes in lifestyle and the presence of memories arising from the persistence of symptoms[39], even after hospital discharge.

The presence of PTSD persisted in the evaluated individuals who recovered from the moderate and severe phases of COVID-19 in our study, which is noteworthy. These same individuals also had repercussions on functional performance. Understanding that the presence of persistent mental health impairment associated with a decline in functional performance should very much be considered in clinical practice.

https://doi.org/10.7322/abcshs.2023158.2451

A possible limitation of this study is the prior lack of knowledge of the PTSD history among the assessed individuals, as well as the lack of assessment of the presence of depression/anxiety, which are frequent in these individuals. Another noteworthy consideration pertains to the convenience sample assessed in our study. The extent to which participants may have had better physical conditions for involvement in the study remains unknown. Consequently, the prevalence of PTSD may not precisely depict the situation for all individuals who underwent moderate/severe forms of Covid-19. As a positive point of the present study, the functional repercussions of these individuals were evaluated four months after recovery, thus proving the persistence of late effects from Covid-19.

The findings of this study showed that moderately to severely recovered individuals from COVID-19 had PTSD, and were characterized as being more sedentary, requiring ICU admission and spending more days in the hospital. From a functional point of view, individuals who had PTSD had a moderate risk of falling, lower performance in both functional capacity and respiratory muscle strength below predicted values. Considering the results of the present study, the follow-up of these individuals needs to be continued in order to verify the permanence of these symptoms and functional manifestations.

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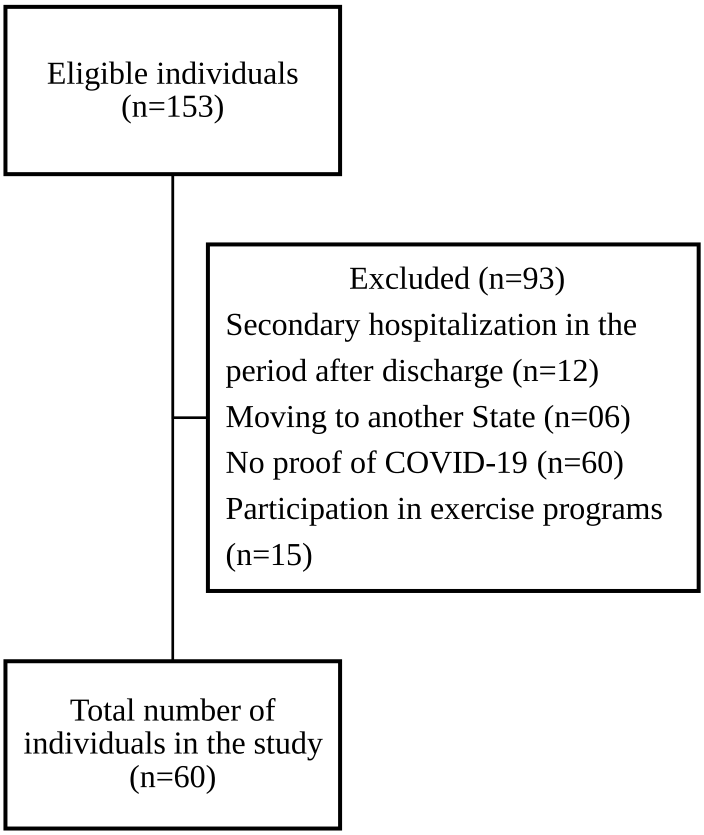

Figure 1: Flowchart of the total number of individuals included in the study.

https://doi.org/10.7322/abcshs.2023158.2451

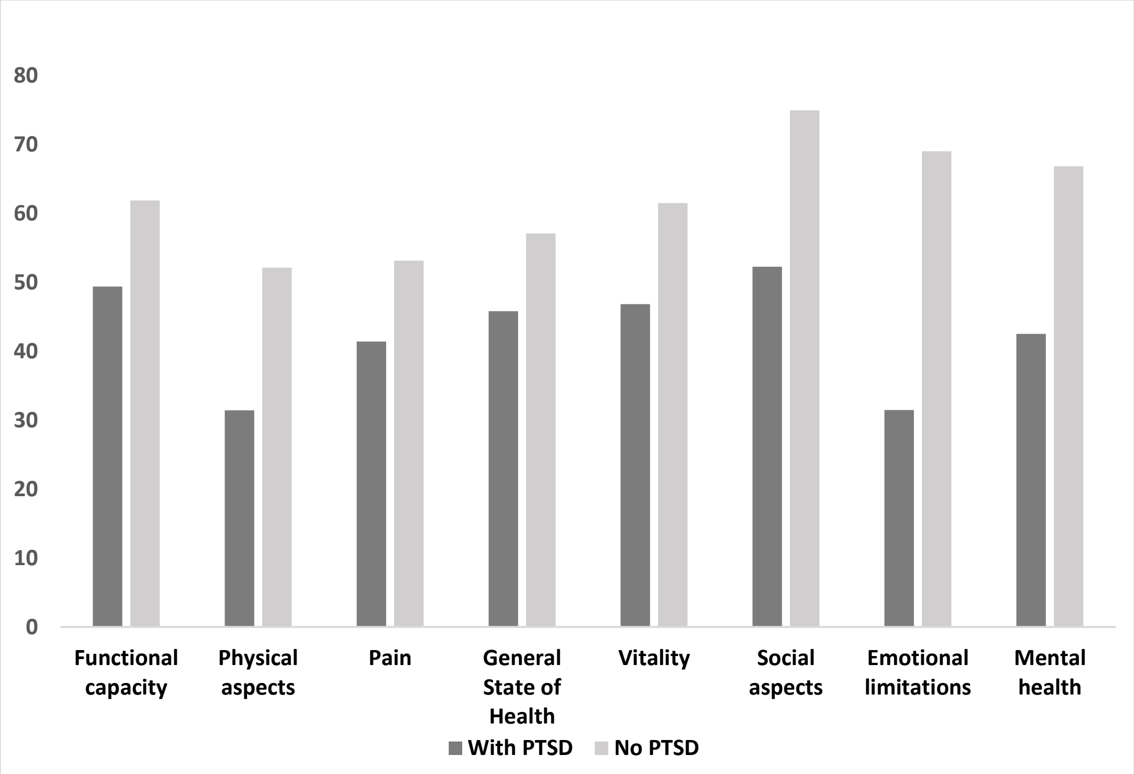

Figure 2: Characteristics of the quality of life of individuals with and without PTSD, post COVID-19.

https://doi.org/10.7322/abcshs.2023158.2451

Table 1: Relationship between the demographic profile of patients with and without PTSD after hospital discharge due to COVID-19, 2022.

Variables	PTSD		p-value
	Yes (n=29) **n (%)**	**No (n=31)** **n (%)**	
Gender (Female)	21 (72.4)	17 (54.8)	0.158
Physical activity level			
Active	8 (27.6)	19 (61.3)	0.009
Sedentary	21 (72.4)	12 (38.7)	
Hospitalization			
Ward	5 (20.0)	20 (80.0)	<0.001
ICU	24 (68.6)	11 (31.4)	
	Mean ± SD	**Mean ± SD**	
Age (Years)	53.03 ± 11.0	54.61 ± 9.47	0.554
BMI (Kg/m²)	32.75 ± 7.68	30.11 ± 4.93	0.123
MM (Kg)	47.04 ± 10.26	50.59 ± 10.19	0.184
LMI (Kg/m²)	17.35 ± 3.51	18.02 ± 2.51	0.400
Hospitalization (Days)	16.93 ± 10.62	11.26 ± 5.16	0.010

Legend: (PTSD) Post-Traumatic Stress Disorder; (DM) Diabetes mellitus; (CKD) chronic kidney disease; (SAH) Systemic arterial hypertension; (HF) Heart failure; (COPD) Chronic obstructive pulmonary disease; (ICU) Intensive Care Unit; (SD) Standard deviation; (BMI) body mass index; (MM) Muscle mass; (LMI) lean mass index. Chi-Squared, Fisher's Exact, and Student’s t-tests.

https://doi.org/10.7322/abcshs.2023158.2451

Table 2: Risk of falls, functional capacity, muscle strength and thickness in post-COVID-19 individuals with and without PTSD.

Variables	PTSD		p-value
	Yes (n=29)	**No (n=31)**	
	n (%)	**n (%)**	
TUG (s)			
Independent	20 (69.0)	29 (93.5)	0.014
Moderate risk of falling	9 (31.0)	2 (6.5)	
	Mean ± SD	**Mean ± SD**	
6MWT			
Distance covered (m)	446.28 ± 83.08	504.68 ± 85.34	0.009
Predicted distance %	77.68 ± 11.83	88.05 ± 11.19	0.001
Time (s)	344.03 ± 34.89	354.03 ± 19.93	0.229
Muscle strength			
MIP (%)	65.05 ± 16.93	84.09 ± 23.21	0.001
MEP (%)	64.57 ± 17.55	78.33 ± 20.72	0.008
HGS (kg/F)	27.62 ± 7.60	31.67 ± 8.77	0.061
Predicted HGS (%)	71.66 ± 14.06	78.58 ± 12.33	0.047
Ultrasound			
Quadriceps (mm)	32.22 ± 7.95	30.78 ± 7.09	0.464

Legend: (TUG) Timed Up and Go test; (SD) Standard deviation; (m) meters; (MIP%) Maximum Inspiratory Pressure percentage; (MEP%) Maximum Expiratory Pressure percentage; (HGS) Handgrip strength, $p<0.05$.

https://doi.org/10.7322/abcshs.2023158.2451