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ORIGINAL ARTICLE

Long COVID: rheumatologic/musculoskeletal symptoms in hospitalized COVID-19 survivors at 3 and 6 months

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Abstract

Objective To document the detailed characteristics including severity, type, and locations of rheumatic and musculoskeletal symptoms along with other COVID-19 persistent symptoms in hospitalized COVID-19 survivors at 3 and 6 months.

Methods In this extension cohort study, two telephone surveys at 3 and 6 months following the hospitalization were carried out. In these telephone surveys, participants were asked regarding their symptoms through a previously designed standard questionnaire.

Results At 3 months, 89.0% of survivors had at least one symptom, 74.6% had at least one rheumatic and musculoskeletal symptom, and 82.1% had at least one other COVID-19 symptom. At 6 months, 59.6% of survivors had at least one symptom, 43.2% had at least one rheumatic and musculoskeletal symptom, and 51.2% had at least one other COVID-19 symptom. Regarding the rheumatic and musculoskeletal symptoms, 31.6% had fatigue, 18.6% had joint pain, and 15.1% had myalgia; and regarding the other-COVID-19-symptoms, 25.3% had dyspnea, 20.0% had hair loss, and 17.2% sweat at 6 months. In an adjusted model, female patients were more likely to have fatigue (OR: 1.99, 95% CI: 1.18–3.34), myalgia (3.00, 1.51–5.98), and joint pain (3.39, 1.78–6.50) at 6 months.

Conclusion Approximately 3 in 5 patients had at least one symptom with ≈2 in 5 patients had at least one rheumatic and musculoskeletal symptom. Fatigue, joint pain, and myalgia were the most frequent rheumatic and musculoskeletal symptoms. Joint pain and myalgia were mostly widespread. This information guide rheumatologists to understand the nature and features of persistent rheumatic and musculoskeletal symptoms in hospitalized COVID-19 survivors and may contribute to better management of these individuals.

Key Points

- *Approximately 3 in 5 patients had at least one symptom with ≈2 in 5 patients had at least one rheumatic and musculoskeletal symptom at 6 months*
- *Fatigue, joint pain, and myalgia were the most frequent rheumatic and musculoskeletal symptoms followed by back pain, low back pain, and neck pain*
- *Dyspnea, hair loss, and sweat were the most frequent other-COVID-19-symptoms*

Keywords Fatigue · Joint pain · Long-haul COVID · Muscle pain · Post-acute COVID-19 syndrome · SARS-CoV-2

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Introduction

Since the emergence in the late of 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has spread across the world leading an unexpected, large, and serious global pandemic [1–5]. By the 5th of July 2021, 182,319,261 confirmed cases of coronavirus disease 2019 (COVID-19), involving 3,954,324 deaths, have been identified worldwide according to the World Health Organization (WHO) [6]. Even though as COVID-19 vaccination becomes more available throughout the world and the COVID-19 infection/death

rates are dropping, clinicians have still caring the COVID-19 survivors who were previously infected and recovered from acute infection and now experience a broad range of persistent symptoms, which are called as post-acute COVID-19 syndrome, long COVID, long-haul COVID, post-COVID condition, or post-acute sequelae of SARS-CoV-2 infection (PASC) [7, 8].

Several observational studies have recently evaluated the persistent symptoms in hospitalized COVID-19 survivors beyond 3 months [9–13]. Although some of these studies have partly described the persistent fatigue, myalgia, and joint pain in hospitalized COVID-19 survivors, they only reported their prevalence. In other words, the severity, type (local or widespread), and locations of persistent rheumatic and musculoskeletal symptoms have not been documented in detail.

Thus, we aimed to document the detailed characteristics including severity, type, and locations of rheumatic and musculoskeletal symptoms along with other COVID-19 persistent symptoms in hospitalized COVID-19 survivors at 3 and 6 months. We also sought to evaluate whether an association exists between the presence of symptoms (i.e., fatigue, myalgia, joint pain) and age, sex, body mass index (BMI), and duration of hospital stay.

Materials and methods

Study design, setting, and ethical approval

We conducted an extension cohort study of our previously published investigation reporting 1-month results [14]. We carried out this study in a tertiary hospital, namely Gülhane Training and Research Hospital. We obtained an ethical approval for this extension study by the Ethic Committee of the Gülhane Scientific Researches, University of Health Sciences (2021/187). We obtained informed verbal consent to participate in the study at the beginning of the telephone interviews. We informed by Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [15] in reporting our study and by standard recommendations [16] in reporting our results.

Study cohort

COVID-19 survivors who aged 18 to 70 years old and who had been discharged after hospital stay due to the acute COVID-19 infection anytime during the November 18, 2020, through January 30, 2021, were included. We included COVID-19 survivors who had been only treated in hospital ward unit; in other words, we excluded survivors who admitted/or were transferred to intensive care unit during their hospital stay.

Data gathering

One author (FK) carried out all telephone surveys at 3 and 6 months following the hospitalization. In these telephone surveys, participants were asked regarding their symptoms through a previously designed standard questionnaire. The following rheumatic and musculoskeletal symptoms were systematically gathered: fatigue, myalgia, joint pain, low back pain, back pain, and neck pain. The type (local, widespread) and locations of myalgia, and joint pain were asked as well. Additionally, the other COVID-19 symptoms were gathered: fever, cough, lack of appetite, dyspnea, diarrhea, sore throat, headache, dizziness, absence of taste, and absence of smell. We evaluated the severity of all these symptoms through a 5-point Likert-type scale.

Statistical analyses

We conducted the analysis with the use of the SPSS v. 21.0 (IBM, Armonk, NY). We analyzed the data and variables through descriptive statistical analyses and expressed the results either as mean ± standard deviation (SD) or number (%). We also tested whether there is an association between the presence of symptoms (i.e., fatigue, myalgia, joint pain) and age, sex, BMI, and duration of hospital stay at 6 months using generalized estimating equations by a selection of binary logistic regression models. The 95% confidence interval (CI) values that did not include 1 indicated statistical significance.

Results

Baseline characteristics

We included a total of 300 COVID-19 survivors in our previous publication presenting 1-month results [14]. At 3 months, there were 9 missing, and at 6 months, there were 6 additional missing survivors. The reasons of these 15 missings were dead ($n=2$), could not be reached through telephone ($n=4$), did not answer to telephone ($n=7$), staying in intensive care unit at the time of assessment ($n=1$), and abdominal hysterectomy with bilateral salpingo-oophorectomy ($n=1$). We presented the baseline demographic and clinical features of the study cohort at 3 ($n=291$) and 6 ($n=285$) months in Table 1.

Symptoms at 3 months

At 3 months, 89.0% of survivors had at least one symptom (in other words, 11.0% had no symptoms), 74.6% had at least one rheumatic and musculoskeletal symptom, and 82.1% had at least one other-COVID-19-symptom. Regarding

Table 1 Baseline characteristics of study population, which have data for 3- and 6-month follow-up

Parameter	3 months ($n=291$)	6 months ($n=285$)
Age, yrs	52.54 ± 12.03	52.32 ± 12.05
Male	173 (59.5)	172 (60.4)
Female	118 (40.5)	113 (39.6)
BMI, kg/m^2	28.96 ± 4.76	28.92 ± 4.77
Schooling grade		
Illiterate	8 (2.7)	8 (2.8)
Primary	101 (34.7)	97 (34.0)
Junior high	31 (10.7)	31 (10.9)
High	51 (17.5)	51 (17.9)
University	100 (34.4)	98 (34.4)
Employed	126 (43.3)	125 (43.9)
Alcohol usage		
Current users	15 (5.2)	15 (5.3)
None	276 (94.8)	270 (94.7)
Smoking status		
Current smoker	22 (7.6)	22 (7.7)
Nonsmoker	220 (75.6)	214 (75.1)
Ex-smoker	49 (16.8)	49 (17.2)
Smoking, pack-years	26.70 ± 15.97	26.70 ± 15.97
Comorbidities		
At least one comorbidity	190 (65.3)	185 (64.9)
Hypertension	93 (32.0)	88 (30.9)
Diabetes mellitus	83 (28.5)	80 (28.1)
Hyperlipidemia	26 (8.9)	25 (8.8)
Coronary artery disease	42 (14.4)	40 (14.0)
Thyroid diseases	12 (4.1)	12 (4.2)
Asthma	19 (6.5)	19 (6.7)
COPD	6 (2.1)	6 (2.1)
Osteoarthritis	8 (2.7)	8 (2.8)
Familial Mediterranean fever	4 (1.4)	4 (1.4)
Rheumatoid arthritis	5 (1.7)	5 (1.7)
Scleroderma	1 (.4)	1 (.4)
Ankylosing spondylitis	1 (.4)	1 (.4)
Psoriatic arthritis	1 (.4)	1 (.4)
Sjogren syndrome	1 (.4)	1 (.4)
SARS-CoV-2 RT-PCR positive	255 (87.6)	249 (87.3)
SARS-CoV-2 infection chest CT scan findings	263 (90.4)	257 (90.1)
Duration from PCR test to hospitalization, days	6.43 ± 3.45	6.42 ± 3.45
Duration of hospital stay, days	7.63 ± 3.96	7.58 ± 3.95

Data are prevalence (%) or mean ± standard deviation. *BMI* body mass index, *COPD* chronic obstructive pulmonary disease, *CT* computed tomography, *RT-PCR* reverse transcriptase–polymerase chain reaction, *SARS-CoV-2* severe acute respiratory syndrome coronavirus 2

the rheumatic and musculoskeletal symptoms, 59.5% had fatigue, 40.6% had myalgia, and 39.2% had joint pain. Regarding the other COVID-19 symptoms, 46.1% had hair loss, 45.0% had dyspnea, and 26.8% had sweat (Tables 2 and 3, Fig. 1).

Symptoms at 6 months

At 6 months, 59.6% of survivors had at least one symptom (in other words, 40.4% had no symptoms), 43.2% had at least one rheumatic and musculoskeletal symptom, and 51.2% had at least one other COVID-19 symptom. Regarding the rheumatic and musculoskeletal symptoms, 31.6% had fatigue,

Table 2 Prevalence of symptoms at 3 and 6 months

Parameter	3 months	6 months
At least one symptom	259 (89.0)	170 (59.6)
At least one rheumatic/musculo-skeletal symptom	217 (74.6)	123 (43.2)
Fatigue	173 (59.45)	90 (31.58)
Myalgia	118 (40.55)	43 (15.09)
Joint pain	114 (39.18)	53 (18.59)
Low back pain	72 (24.74)	32 (11.23)
Back pain	92 (31.62)	41 (14.39)
Neck pain	60 (20.62)	27 (9.47)
At least one other COVID-19 symptom	239 (82.1)	146 (51.2)
Fever	8 (2.75)	1 (0.35)
Cough	40 (13.75)	16 (5.61)
Lack of appetite	19 (6.53)	6 (2.11)
Dyspnea	131 (45.02)	72 (25.26)
Diarrhea	18 (6.19)	8 (2.81)
Sore throat	38 (13.06)	19 (6.67)
Headache	71 (24.40)	27 (9.47)
Dizziness	55 (18.90)	16 (5.61)
Absence of taste	24 (8.25)	11 (3.86)
Absence of smell	37 (12.71)	15 (5.26)
Sweat	78 (26.80)	49 (17.19)
Hair loss	134 (46.05)	57 (20.00)

Data are prevalence (%)

18.6% had joint pain, and 15.1% had myalgia. Regarding the other COVID-19 symptoms, 25.3% had dyspnea, 20.0% had hair loss, and 17.2% sweat (Tables 2 and 3, Fig. 1).

Location of arthralgia and myalgia at 6 months

Joint pain and myalgia were widespread (64.2% and 69.8%, respectively); if regional, joint pain was mostly in the knee, foot–ankle, and shoulder, and myalgia was mostly in the lower leg, arm, and shoulder girdle (Table 4).

Regression analyses results

In an adjusted model, female patients were more likely to have fatigue (OR: 1.99, 95% CI: 1.18–3.34), myalgia (3.00, 1.51–5.98), and joint pain (3.39, 1.78–6.50) at 6 months, whereas no association was observed between age/BMI/duration of hospital stay and fatigue/myalgia/joint pain (Table 5).

Table 3 Severity of symptoms at 3 and 6 months

Parameter	3 months	6 months
Fatigue		
None	118 (40.5)	195 (68.4)
Mild	62 (21.3)	60 (21.1)
Moderate	80 (27.5)	21 (7.4)
Severe	25 (8.6)	8 (2.8)
Very severe	6 (2.1)	1 (.4)
Myalgia		
None	173 (59.5)	242 (84.9)
Mild	35 (12.0)	22 (7.7)
Moderate	55 (18.9)	15 (5.3)
Severe	24 (8.2)	6 (2.1)
Very severe	4 (1.4)	0
Joint pain		
None	177 (60.8)	232 (81.4)
Mild	34 (11.7)	25 (8.8)
Moderate	57 (19.6)	22 (7.7)
Severe	21 (7.2)	6 (2.1)
Very severe	2 (.7)	0
Low back pain		
None	219 (75.3)	253 (88.8)
Mild	27 (9.3)	14 (4.9)
Moderate	34 (11.7)	15 (5.3)
Severe	9 (3.1)	1 (.4)
Very severe	2 (.7)	2 (.7)
Back pain		
None	199 (68.4)	244 (85.6)
Mild	36 (12.4)	23 (8.1)
Moderate	40 (13.7)	17 (6.0)
Severe	14 (4.8)	1 (.4)
Very severe	2 (.7)	0
Neck pain		
None	231 (79.4)	258 (90.5)
Mild	25 (8.6)	17 (6.0)
Moderate	20 (6.9)	7 (2.5)
Severe	14 (4.8)	3 (1.1)
Very severe	1 (.3)	0
Fever		
None	283 (97.3)	284 (99.6)
Mild	6 (2.1)	1 (.4)
Moderate	1 (.3)	0
Severe	1 (.3)	0
Very severe		
Cough		
None	251 (86.3)	269 (94.4)
Mild	26 (8.9)	12 (4.2)
Moderate	10 (3.4)	4 (1.4)
Severe	4 (1.4)	0
Very severe	0	0
Lack of appetite		
None	272 (93.5)	279 (97.9)

Table 3 (continued)

Parameter	3 months	6 months
Mild	7 (2.4)	3 (1.1)
Moderate	10 (3.4)	3 (1.1)
Severe	2 (.7)	0
Very severe	0	0
Dyspnea		
None	160 (55.0)	213 (74.7)
Mild	58 (19.9)	52 (18.2)
Moderate	58 (19.9)	17 (6.0)
Severe	14 (4.8)	3 (1.1)
Very severe	1 (.3)	0
Diarrhea		
None	273 (93.8)	277 (97.2)
Mild	6 (2.1)	7 (2.5)
Moderate	10 (3.4)	1 (.4)
Severe	2 (.7)	0
Very severe	0	0
Sore throat		
None	253 (86.9)	266 (93.7)
Mild	30 (10.3)	14 (4.9)
Moderate	5 (1.7)	4 (1.4)
Severe	2 (.7)	0
Very severe	1 (.3)	0
Headache		
None	220 (75.6)	258 (90.5)
Mild	31 (10.7)	22 (7.7)
Moderate	23 (7.9)	3 (1.1)
Severe	13 (4.5)	2 (.7)
Very severe	4 (1.4)	0
Dizziness		
None	236 (81.1)	269 (94.4)
Mild	26 (8.9)	14 (4.9)
Moderate	23 (7.9)	1 (.4)
Severe	5 (1.7)	1 (.4)
Very severe	1 (.3)	0
Absence of taste		
None	267 (91.8)	274 (96.1)
Mild	3 (1.0)	5 (1.8)
Moderate	12 (4.1)	4 (1.4)
Severe	7 (2.4)	1 (.4)
Very severe	2 (.7)	1 (.4)
Absence of smell		
None	254 (87.3)	270 (94.7)
Mild	9 (3.1)	6 (2.1)
Moderate	14 (4.8)	5 (1.8)
Severe	8 (2.7)	3 (1.1)
Very severe	6 (2.1)	1 (.4)
Sweat		
None	213 (73.2)	236 (82.8)
Mild	20 (6.9)	19 (6.7)
Moderate	22 (7.6)	11 (3.9)
Severe	20 (6.9)	19 (6.7)
Very severe	16 (5.5)	0
Hair loss		
None	157 (54.0)	228 (80.0)
Mild	17 (5.8)	38 (13.3)
Moderate	26 (8.9)	7 (2.5)
Severe	25 (8.6)	10 (3.5)
Very severe	66 (22.7)	2 (.7)

Data are prevalence (%)

Discussion

We showed that approximately 3 in 5 patients had at least one symptom with approximately 2 in 5 patients had at least one rheumatic and musculoskeletal symptom and just over than half of the patients had at least one other COVID-19 symptom at 6 months. Fatigue (approximately 1 in 3), joint pain (approximately 1 in 5), and myalgia (approximately 1 in 7 patients) were the most frequent rheumatic and musculoskeletal symptoms. Joint pain and myalgia were mostly widespread. Dyspnea (approximately 1 in 4), hair loss (approximately 1 in 5), and sweat (approximately 1 in 6) were the most frequent other COVID-19 symptoms. Furthermore, female patients were more likely to have fatigue, myalgia, and joint pain at 6 months.

In the literature, some observational studies investigated the persistent symptoms in hospitalized COVID-19 survivors beyond 3 months [9–13]. Ghosn and colleagues analyzed 1137 hospitalized survivors (of which 288 admitted to the intensive care unit) and found that 60% had at least one symptom at 6 months, most frequently fatigue, dyspnea, joint pain, and muscle pain [11]. Peghin and colleagues evaluated 599 survivors (outpatients, $n=442$; hospital ward unit, $n=134$; the intensive care unit, $n=23$) and reported that 52% of hospital ward unit survivors had post-COVID-19 syndrome at 6 months [12]. Our data at 6 months showed that 59.6% of survivors had at least one symptom, in consistent with previous two studies [11, 12]. Garrigues and colleagues assessed 120 survivors through telephone surveys after a mean of 111 days after admission either to the hospital ward unit ($n=96$) or to the intensive care unit ($n=24$) and documented that 54.2% had fatigue, 39.6% had dyspnea, 14.6% had cough, 14.6% had anosmia, and 9.4% had ageusia in the hospital ward unit group [9]. González-Hermosillo and colleagues assessed 130 survivors through telephone surveys and reported that 46.9% had fatigue, 43.8% joint pain, 42.3% had dyspnea, 36.2% muscle pain, 6.9% had anosmia, and 5.4% had ageusia at 6 months [10]. Fortini and colleagues assessed 59 survivors after a median

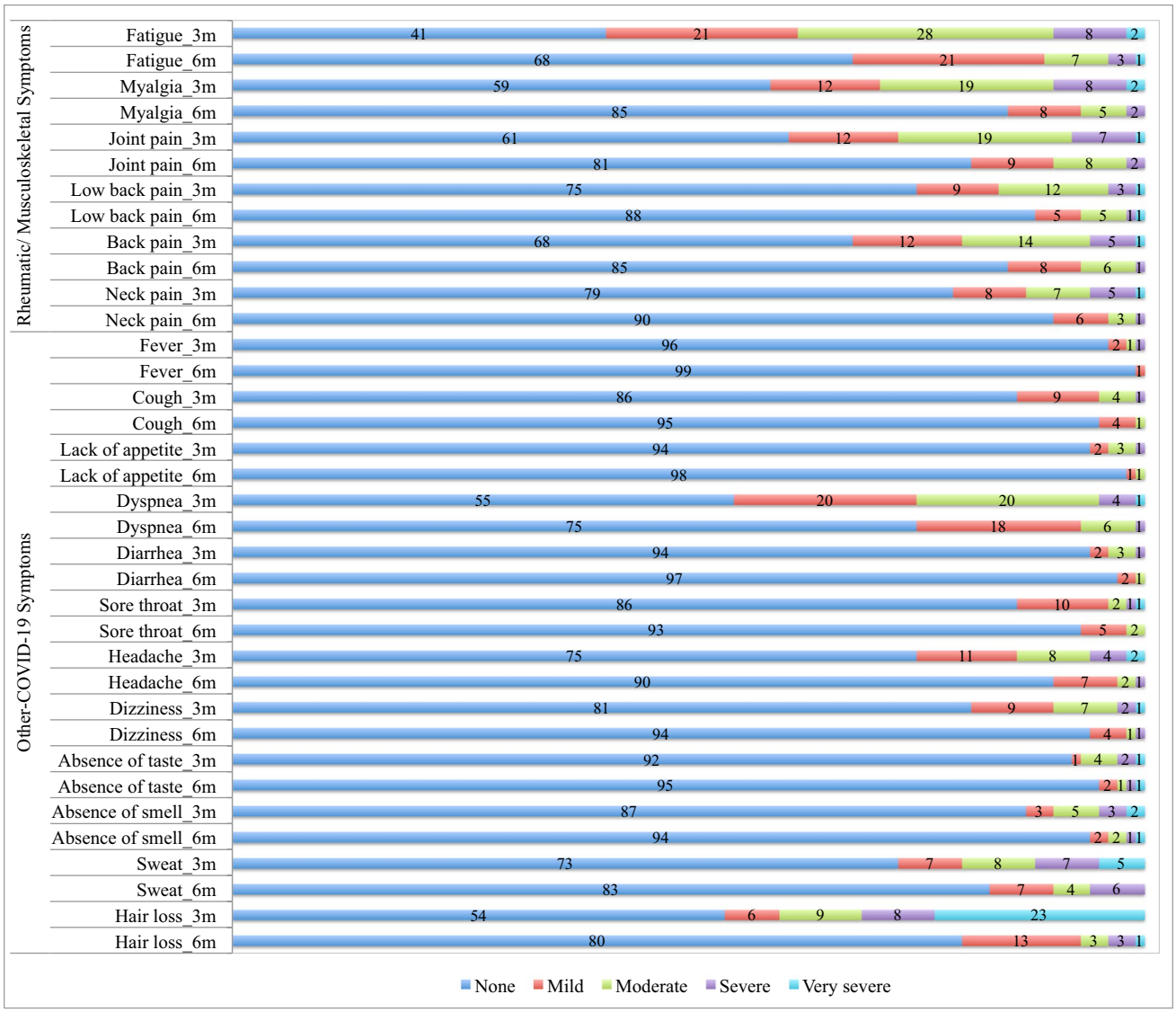

Fig. 1 Severity of rheumatic/musculoskeletal symptoms and other COVID-19 symptoms at 3 and 6 months. Data are percentage

of 123 days after discharge from the hospital ward unit and observed that 42.4% had fatigue, 37.3% had dyspnea, 16.9% had ageusia, 15.2% had anosmia, 11.9% had cough, 8.5% joint pain, and 8.5% myalgia [13]. In those earlier investigations, generally fatigue and dyspnea were the most frequent symptoms. In our study, fatigue (approximately 1 in 3) and dyspnea (approximately 1 in 4) were the two most common symptoms as well. Also, we showed that joint pain and myalgia were each observed in approximately one-sixth of patients, and back pain, low back pain, and neck pain were each observed in approximately one-tenth of patients. With regard to the other COVID-19 symptoms, hair loss and sweat were each observed in approximately one-fifth of patients with less frequently, headache, sore throat, dizziness, cough, absence of smell, lack of appetite, absence of taste, diarrhea, lack of appetite, and fever. Considering the broad range of symptoms, multidisciplinary teams involving rheumatologists should provide a care for COVID-19 survivors.

In a study evaluating severe fatigue on 239 COVID-19 patients confirmed by PCR/CT, it was shown that severe fatigue lasted 12–23 weeks after the initial symptoms of the disease. It has been stated that the prevalence of long-term persistence of severe fatigue is high [17]. In another study, excessive fatigue persisted in 26 (33.3%) of 78 patients at 3-month follow-up and in 9 (39.1%) of 23 patients at 6-month follow-up [18]. In our study, severe/very severe fatigue was present in 10.7% of patients at 3 months and 3.2% at 6 months.

Table 4 Location of myalgia and arthralgia symptoms at 3 and 6 months

Parameter	3 months	6 months
Myalgia		
Present	118 (100.0)	43 (100.0)
Widespread	74 (62.7)	30 (69.8)
Regional	44 (37.3)	13 (30.2)
Shoulder girdle	6 (13.6)	2 (15.4)
Arm	13 (29.5)	2 (15.4)
Upper leg	0	0
Lower leg	25 (56.8)	9 (69.2)
Joint pain		
Present	114 (100.0)	53 (100.0)
Widespread	68 (59.6)	34 (64.2)
Regional	46 (40.4)	19 (35.8)
Shoulder	8 (17.0)	4 (21.1)
Elbow	1 (2.1)	0
Hand-wrist	3 (6.4)	1 (5.3)
Hip	8 (17.0)	2 (10.5)
Knee	15 (31.9)	6 (31.6)
Foot–ankle	11 (23.4)	6 (31.6)

Data are frequency (percentage)

We showed that female patients were more likely to have fatigue, myalgia, and joint pain at 6 months. This finding was consistent with two previous studies [11, 12], which showed an association of female sex and post-COVID symptoms. Our study provides information on association of female sex with rheumatic/musculoskeletal symptoms, therefore, extends the results of previous studies.

In the recent review, possible mechanisms that predominantly contribute to post-acute COVID-19 symptoms were listed as cellular invasion by SARS-COV-2, inflammatory and the immune response, and sequelae of post-critical illness [19]. Also, transforming growth factor beta (TGF-β) overexpression causing a prolonged state of immunosuppression and fibrosis was proposed as a unifying hypothesis mechanism for persistent post-COVID syndrome [20]. However, further research is warranted to elaborate the pathophysiologic mechanisms of wide spectrum of manifestations including rheumatologic/musculoskeletal involvement of post-COVID syndrome.

Limitations and strengths

We must acknowledge the limitations of our study. As we only included COVID-19 survivors who had been treated in hospital ward unit, our results are not generalizable to outpatient survivors or to those who admitted to intensive care unit. Also, it was an uncontrolled cohort study, the results would have been better interpreted if a comparative group who were hospitalized for other reasons than COVID-19 could exist. Furthermore, some factors such as medicines patients used might contribute to developing symptoms; however, the study did not investigate these factors. On the other hand, our study has several strengths. It was a prospective study with a relatively long-term follow-up period.

Conclusion

Approximately 3 in 5 patients had at least one symptom with ≈2 in 5 patients had at least one rheumatic and musculoskeletal symptom and just over than half of the patients had at least one other COVID-19 symptom at 6 months. Fatigue, joint pain, and myalgia were the most frequent rheumatic and musculoskeletal symptoms. Joint pain and myalgia were mostly widespread. Dyspnea, hair loss, and sweat were the most frequent other COVID-19 symptoms. Furthermore, female patients were more likely

Table 5 Association between the presence of symptoms (i.e., fatigue, myalgia, joint pain) and age, sex, BMI, and duration of hospital stay at 6 months

Parameter	Fatigue		Myalgia		Joint pain	
	Crude OR	Adjusted OR	Crude OR	Adjusted OR	Crude OR	Adjusted OR
Age	1.02 (0.99–1.04) *P*: 0.104	1.02 (0.99–1.04) *P*: 0.186	1.03 (0.99–1.06) *P*: 0.081	1.02 (0.99–1.05) *P*: 0.223	1.05 (1.02–1.08) *P*: 0.001	1.04 (1.01–1.08) *P*: 0.004
Female sex	2.14 (1.28–3.55) *P*: 0.003	1.99 (1.18–3.34) *P*: 0.010	3.06 (1.56–5.99) *P*: 0.001	3.00 (1.51–5.98) *P*: 0.002	3.47 (1.86–6.47) *P*: < 0.001	3.39 (1.78–6.50) *P*: < 0.001
BMI	1.06 (1.01–1.12) *P*: 0.035	1.05 (0.99–1.11) *P*: 0.109	1.04 (0.97–1.11) *P*: 0.277	1.02 (0.95–1.08) *P*: 0.616	1.04 (0.98–1.11) *P*: 0.161	1.02 (0.96–1.08) *P*: 0.584
Duration of hospital stay	1.00 (0.94–1.07) *P*: 0.986	0.99 (0.93–1.07) *P*: 0.87	1.05 (0.97–1.13) *P*: 0.219	1.04 (0.96–1.13) *P*: 0.325	1.05 (0.98–1.13) *P*: 0.217	1.03 (0.94–1.12) *P*: 0.566

We performed generalized estimating equations by a selection of binary logistic regression models. In adjusted analyses of age, sex, BMI, and duration of hospital stay, the remaining 3 parameters were controlled in the models. *BMI* body mass index, *OR* Odds ratio

to have fatigue, myalgia, and joint pain at 6 months. This information guide rheumatologists to understand the nature and features of persistent rheumatic and musculoskeletal symptoms in hospitalized COVID-19 survivors and may translate into improved management of such individuals with persistent symptoms who had recovered from acute COVID-19 infection.

Declarations

Ethical approval We obtained an ethical approval by the Ethic Committee of the Gülhane Scientific Researches, University of Health Sciences (decision no: 2021/187).

Conflict of interest We declare that we have no conflicts of interest regarding the submitted manuscript. Outside of the submitted manuscript SK has received congress travel, accommodation, and participation fee support (12th Anatolian Rheumatology Days) from AbbVie.

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