ORIGINAL RESEARCH   **CORONA EXPERIENCE**

The Post-COVID-19 Functional Status Scale in moderate and severe COVID-19 infections in a tertiary referral hospital in Indonesia: a retrospective study

Suwarman Suwarman [1], Fityan Aulia Rahman [2]

Author affiliations:

1. Suwarman Suwarman, Department of Anesthesiology and Intensive Care, Faculty of Medicine Universitas Padjadjaran / Dr. Hasan Sadikin National Referral and Teaching Hospital, Bandung, West Java, Indonesia; E-mail: Suwarman@unpad.ac.id; {ORCID:0000-0002-1960-2736}
2. Fityan Aulia Rahman, Department of Anesthesiology and Intensive Care, Faculty of Medicine Universitas Padjadjaran / Dr. Hasan Sadikin National Referral and Teaching Hospital, Bandung, West Java, Indonesia; E-mail: fityanauliar@gmail.com; {ORCID:0000-0002-5768-084X}

Correspondence: Suwarman Suwarman, **E-mail:** Suwarman@unpad.ac.id; **Mobile:** +62 812-2171-673

ABSTRACT

Background & objective: Coronavirus disease 2019 (COVID-19) is known to have caused respiratory function derangement that can affect changes in the body's physiological conditions even after the active phase of infection is over. This study aimed to overview the Post-COVID-19 Functional Status (PCFS) scale at the 3rd and 6th months after treatment of moderate to severe COVID-19 infections in our tertiary referral hospital.

Methodology: A descriptive observational study was conducted for confirmed COVID-19 patients with moderate to severe symptoms treated in Hasan Sadikin Hospital from June-August of 2021 by following them at third- and sixth-month post-infection and their PCFS was recorded. A total of 153 patients were enrolled in the study.

Results: Eighty subjects (52.3%) were male, and 91 subjects (59.4%) had an average body mass index. Thirty-seven (24.2%) patients were diagnosed with severe symptoms, and 116 (75.8%) were diagnosed with moderate symptoms. In their third month post-infection, 30.7% of patients were on a scale of 0, 32.7% on a scale of 1, 20.9% on a scale of 2, 12.4% on a scale of 3, and 3.3% on a scale of 4. In their sixth month post-infection, 81.7% of patients were on a scale of 0, 15% on a scale of 1, and 3.3% on a scale of 3.

Conclusion: The assessment of post-COVID-19 functional status has a significant role in understanding the pathophysiology and recovery process of the disease. The patients are recommended to have medical check-ups regarding organ function to determine the impact of COVID-19 and advised to undergo medical rehabilitation to return to their initial functional status.

Keywords: COVID-19; Functional Status; PCFS; Post-Infection; Questionnaire

1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an acute respiratory tract infectious disease, caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), a ribonucleic acid (RNA) virus. Most people infected with the virus experience mild to moderate respiratory illness and recover without any treatment, but some will become seriously ill and require medical attention.[1–3] In August 2021, according to World Health Organization (WHO) data, the COVID-19 pandemic resulted in more than 211 million cases and more than 4.4 million deaths globally. Until October 14, 2021, Indonesia had 4,223,014 cases of COVID-19.[4]

The severity of COVID-19 symptoms can be classified, into asymptomatic, mild, moderate, severe, and critical cases. Although 80% of COVID-19 sufferers have mild symptoms and do not require hospital treatment, 14%

require treatment in a non-intensive care unit, and 6% require intensive care unit (ICU) treatment. Patients with severe and acute symptoms will develop Acute Respiratory Distress Syndrome (ARDS), which can affect the physical function of the lungs and life quality for several months and even years.[5]

Various healthcare centers worldwide are mostly focused on reducing the acute phase of SARS-Cov-2 infection. However, over time, much evidence shows that SARS-Cov-2 infection can cause long-term physical and mental health problems. Recovery from COVID-19 can take weeks to months in both hospitalized and non-hospitalized adult patients. Post-COVID-19 syndrome is a collection of long-term complications of this infection with an onset of more than four weeks after the acute symptoms. Case reports and several cohort studies indicate persistent symptoms (>12 weeks after COVID-19 infection), such as fatigue, shortness of breath, chest tightness, headache, and muscle aches, among other symptoms.[4–8]

Functional status is a process to determine the patient's ability to perform specific activities concerning the routines of daily life that are integrated with their activity environment. Post-COVID-19 Functional Status (PCFS) questionnaire describes the patient's functional status, which focuses on limitations in daily activities and lifestyle changes, which are shown on six scales, ranging from mild to severe.[9,10] We aimed to overview the PCFS scale in patients at the 3rd and 6th months after treatment of moderate and severe COVID-19 infections at Hasan Sadikin Hospital.

2. METHODOLOGY

This research conformed to the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) guidelines.[11] This is a descriptive retrospective observational study with a cross-sectional design. Telephone interviews were carried out as data collection to assess health status in the 3rd and 6th months based on the PCFS questionnaire. The PCFS score is a tool used to assess the functional status of individuals who have recovered from COVID-19. It is designed to measure the impact of COVID-19 on a person's daily life and activities over time. The PCFS score provides a way to quantify the extent of functional limitations and helps in understanding the long-term effects of COVID-19 on health. The PCFS scale includes the following grades: Grade 0: No functional limitations; Grade 1: Negligible functional limitations; minor symptoms that do not interfere with daily activities; Grade 2: Slight functional limitations; some reduction in activity level but still able to perform all activities of daily living; Grade 3: Moderate functional limitations; significant reduction in activity level and difficulty

performing some activities of daily living; and Grade 4: Severe functional limitations; severe reduction in activity level and inability to perform activities of daily living without assistance. The PCFS score helps healthcare providers to monitor recovery progress, plan rehabilitation strategies, and conduct research on the long-term impacts of COVID-19.

The inclusion criteria in this study were moderate and severe COVID-19 infection patients who had been treated in the isolation room of a tertiary hospital in June to August 2021. The exclusion criteria were patients who refused to be included, patients who could not be contacted, and patients who did not remember their condition three months after being discharged from the hospital. This study was approved by The Research Ethics Committee of Dr. Hasan Sadikin General Hospital Bandung IRB (COA number: LB.02.01/X.6.5/82/2022). The total sampling method was used in the study. Numerical scale data are presented with mean, standard deviation, median, and range. Categorical scale data is coded and presented as frequency and percentage. The information was recorded in a particular form and then processed with the Statistical Package for the Social Sciences (SPSS) version 26.0 for the Windows program.

3. RESULTS

A retrospective study was conducted on 241 patients with moderate and severe COVID-19 treated at a tertiary hospital in Bandung, Indonesia from June to August 2021. A total of 56 patients died during hospitalization and 32 patients were not contactable. As many as 153 patients met the inclusion criteria and were found eligible.

3.1. Characteristics of participants

The demographic data and the patients' characteristics are presented in Table 1.

3.2 Laboratory results

This study presents data on patient characteristics based on the results of laboratory tests; e.g., Total Lymphocyte Count (TLC), Neutrophil Lymphocyte Ratio (NLR), D-dimer, fibrinogen, and C-Reactive Protein (CRP), PaO2/FiO2 (PF-ratio), and length of treatment. Table 2 shows that the average length of stay, the shortest and the longest length of stay. The average value of TLC and the highest value is given. NLR value, the value of D-dimer, fibrinogen, CRP and the PF ratio are given. Laboratory values when patients were admitted were said to be predictors of mortality in patients with COVID-19 infection. Some patients experienced an average recovery of 6 months after COVID-19, allowing for a functional decline in daily activities.

Table 1: Distribution of patients by sex, age, comorbidities, and BMI (n = 153)

Characteristics		n (%)
Gender	Male	80 (52.3)
	Female	73 (47.7)
Age (y)	18-64	126 (82.4)
	≥ 65	27 (17.6)
Comorbidities	No comorbid	78 (51)
	1 comorbid	39 (25.5)
	≥ 2 comrbids	36 (23.5)
Severity of COVID-19	Moderate	116 (75.8)
	Severe	37 (24.2)
BMI (kg/m^2)	< 18.5	3 (2)
	18.5 – 24.9	90 (58.8)
	≥ 25	60 (39.2)

Table 2: Laboratory investigations of the patients

Laboratory data	Median (Min-Max)
Length of stay (days)	14 (2-44)
TLC (cell/µl)	1020 (5.5-3190)
NLR (%)	5.85 (0.87-98.75)
D-dimer (µg/ml)	1.56 (0.19-62.79)
Fibrinogen (mg/dl)	504.5 (1.3-993)
CRP (mg/l)	5.37 (0.08-132.6)
PF ratio (mmHg)	97.9 (44-336.7)

Table 3: Distribution of respondents based on functional status in 3rd month and 6th month (n = 153)

PCSF Score	Follow-Up		P-value
	3rd month	6th month	
0	47 (30.7)	51 (32.7)	0.0001
1	125 (81.7)	23 (15)	0.0001
2	31 (22.9)	5 (3.3)	0.0001
3	19 (12.4)	0	
4	5 (3.3)	0	

Data presented as n (%)

3.3 Functional Status

Functional status data is presented in Table 3. Fifty-one respondents (32.7%) had a functional status of 1. Meanwhile, 24 (15.7%) of respondents had a severe functional status (degrees 3 and 4). In the sixth month of follow-up, respondents only had functional status with degrees 0, 1, and 2. As many as 125 (81.7%) respondents had functional status grade 0.

In the third month of monitoring, among those with a history of moderate COVID-19, 4 patients (3.4%) experienced moderate functional limitations (level 3) and 1 patient (0.9 %) with severe functional limitations (level 4). Meanwhile, in patients with a history of severe COVID-19, there were as many as 15 patients (40.5%) with a PCFS scale of 3 and 4 patients (10.9%) with a PCFS scale of 4.

The results of the research data are presented in Table 4. Patient monitoring continued until the sixth month when patients with a history of moderate COVID-19 had an increased functional scale. As many as 108 patients (93.1%) had no functional limitations and only eight patients (6.9%) still had functional limitations (level 1). Meanwhile, in patients with a history of severe COVID-19, 5 patients (13.6%) claimed to have a slight functional limitation (level 2). This was probably due to many systemic changes caused by COVID-19 infection.

3.4. Comorbids and Functional Status

Based on the monitoring results in the third month, those patients without any comorbidities had a PCFS score of 3 in 5 patients (6.4%) and 4 in 2 patients (2.5%). Patients with one comorbidity had a PCFS scale of 3 in 6 patients (15.3%) and 4 in 1 (2.7%) patient. As for the group of patients with two comorbidities, there were 8 patients (22.2%) with a PCFS level of 3 and 2 patients (5.6%) with a PCFS level of 4.

In the sixth month of monitoring, there was no severe functional status (levels 3 and 4) in all patients. Those without comorbidities had a better functional status than the other two groups; there were 71 patients (91.1%) with a PCFS scale of 0, 6 patients (7.7%) with a PCFS scale of 1, and 1 patient (1.2%) with a PCFS scale of 2. Data is presented in Table 5. By comparing the results of the two tables, we can see that there is a significant functional status improvement in patients with no comorbidities and those with one comorbidity. This improvement was more evident in the 6th month of monitoring. For patients with two or more comorbidities, there was still a notable improvement in functional status but was less significant compared to the others. Overall, the data suggests that patients with comorbidities, particularly those with multiple comorbidities, may have a slower recovery of functional status compared to those without any or single comorbidity.

3.5. BMI and Functional Status

The group of patients with a BMI range of <18.5 kg/m^2 found that 3 patients (2%) were underweight, 90 patients (58.8%) were in the normal BMI range, and 39.2% were overweight. The average BMI was 24.5 kg/m^2.

Table 4: Distribution of respondents based on functional status and severity of symptoms (n = 153)

Severity of symptoms	Time	PCSF Score				
		0	1	2	3	4
Moderate	3rd month	46 (39.6)	44 (37.9)	21 (18.2)	4 (3.4)	1 (0.9)
	6th month	108 (93.1)	8 (6.9)	0	0	0
	P	0.005	0.001	-	-	-
Severe	3rd month	1 (2.7)	6 (16.2)	11 (29.7)	15 (40.5)	4 (10.9)
	6th month	17 (45.9)	15 (40.5)	5 (13.6)	0	0
	P	0.02	0.005	0.04	-	-

Data presented as n (%)

Table 5: Distribution of respondents based on functional status and comorbids (n = 153)

Comorbids	Time	PCSF Score				
		0	1	2	3	4
No comorbid	3rd month	32 (41)	27 (34.7)	12 (15.4)	5 (6.4)	2 (2.5)
	6th month	71 (91.1)	6 (7.7)	1 (1.2)	0	0
	P	0.04	0.003	0.001	-	-
1 comorbid	3rd month	9 (23.1)	12 (30.7)	11 (28.2)	6 (15.3)	1 (2.7)
	6th month	30 (76.9)	7 (17.9)	2 (5.2)	0	0
	P	0.002	0.04	0.006	-	-
≥ 2 comorbids	3rd month	6 (16.7)	11 (30.5)	9 (25)	8 (22.2)	2 (5.6)
	6th month	24 (66.7)	10 (27.7)	2 (5.4)	0	0
	P	0.001	0.06	0.04	-	-

Data presented as n (%)

Table 6: Distribution of respondents based on functional status and BMI (n = 153)

BMI (kg/m^2)	Time	PCSF Score				
		0	1	2	3	4
< 18.5	3rd month	0	0	3 (100)	0	0
	6th month	2 (66.7)	1 (33.3)	0	0	0
	P	0.02	0.01	0.02	-	-
18.5 – 24.9	3rd month	31 (34.4)	26 (28.9)	15 (16.7)	14 (15.6)	4 (4.4)
	6th month	73 (81.1)	13 (14.4)	4 (4.5)	0	0
	P	0.001	0.02	0.03	-	-
≥ 25	3rd month	16 (26.7)	24 (40)	14 (23.3)	5 (8.3)	1 (1.7)
	6th month	50 (83.3)	9 (15)	1 (1.7)	0	0
	P	0.003	0.002	0.01	-	-

Data presented as n (%)

Overweight subjects had PCFS of 3 and 4, respectively in 7 and 2 patients. Data is presented in Table 6.

It appears that there were some differences in the relationship between BMI and functional status during the 3rd and 6th months of monitoring. During the 3rd month of monitoring, the majority of patients with a BMI of 18.5-24.9 and ≥ 25 had a PCFS score of 1 or 2, while the majority of patients with a BMI <18.5 had a PCFS score of 3 or 4. During the 6th month of monitoring, there were fewer patients with a BMI <18.5, but it still had the highest percentage of patients with a PCFS score of 3 or 4. Interestingly, in at the 6th month of monitoring, patients with a BMI of 18.5-24.9 had a higher percentage of patients with a PCFS score of 1 or 2 compared to the 3rd month of monitoring. It's important to note that these interpretations are based on the limited information provided in the tables and further analysis may be needed to fully understand the relationship between BMI and functional status based on the PCFS questionnaire over time.

4. DISCUSSION

In this study, most of the patients receiving treatment for confirmed COVID-19 were male. A similar study by Leite et al. in Brazil showed the same results where there were more men than women with a presentation of 75%; and a study conducted by Jacobs in New Jersey, America, had more men with a presentation of 61.5%.[12] Another study in Michigan, America, found that the number of men was 51.8%. However, in another study by Hussein et al. in Egypt, there were more women (56.8%) than men. Epidemiologically, men are more susceptible to COVID-19 infection with a more severe disease than women.[13–16]

Most of the patients in this study aged from 18 to 64 y. From a study conducted by Leite in Brazil, found a mean age of 60 ± 15 y; and a study conducted by Hussein in Egypt, the patients' mean age was 33.09 ± 12.09 y.[16] In the study conducted in Spain by Taboada et al., it was stated that advanced age affected the results of functional status based on PCFS, especially during monitoring at the sixth month.[12] However, in this study, in the 18–64-year age group, there were still respondents who had a PCFS scale of 4, while in geriatric age over 64 y, they did not.

Patients with more and equal to 2 comorbidities had a higher PCFS scale than patients without any or single comorbidity. This was like a study conducted by Machado et al. in the Netherlands. In addition, another study by Gamal et al. in Egypt stated that increasing age and comorbidities were significantly associated with poorer functional status in patients with COVID-19 (P < 0.001) [17]. In another study conducted by Banic et al. in Croatia, it was found that comorbidities affect the

outcome of the PCFS score [4,5]. In this study, it was found that patients with hypertension had the highest number, followed by diabetes. Patients with hypertension had a higher degree of PCFS than patients with other comorbidities.

During hospitalization, all patients underwent hematological examination and chest X-rays, as well as periodic swab evaluations. Examining laboratory values should ideally be carried out when the patient is first admitted to the hospital and then periodically re-examined during treatment. It is known that some laboratory values can be a predictor of mortality. A survey conducted by Sanchez-Ramirez found that post-COVID-19 infection patients who had a decreased pulmonary function were likely to experience a decrease in functional status for the next six months.[5,7] The results of our study are listed in Table 2.

In a study conducted by Tudoran et al., it was found that patients with a BMI of 30 kg/m^2 had a PCFS scale that spread over 1-3 (with a median of 2) than patients with a normal BMI (P < 0.001). Patients with moderate-grade COVID-19 infection have clinical signs of pneumonia (fever, cough, shortness of breath, rapid breathing) but SpO$_2$ > 93% on air. In contrast, patients with severe COVID-19 infection have clinical signs of pneumonia (fever, cough, shortness of breath, rapid breathing) plus respiratory rate > 30 breaths/min, severe respiratory distress, or SpO$_2$ < 93% on room air. Patients with rapid (> 50%) worsening of pulmonary imaging within 24-48 h should be considered as severe type. In a study by Taboada in Spain, it was found that patients with severe COVID-19 had lower functional status than patients with moderate degrees (81.3% vs. 40.4%, P < 0.001).[12,18]

From the results of this study, it was found that the majority of patients with COVID-19 had decreased functional status six months after hospitalization. A 2-level decrease in functional status was reported more frequently in patients admitted to the ICU. In patients treated in the ICU, the limitation to perform daily activities (PCFS level 2-4) was found to be 56.4%, while in patients who were not admitted to the ICU, it was found to be 17.9% (P < 0.0001). In this study, 81% of patients with severe disease had a PCFS level of 2-4, while in patients with moderate disease, it was found to be 25%. At the 6th month of monitoring, the majority of patients, both moderate and severe disease experienced an improvement in their functional status (PCFS level of 0-2).[19]

In a study conducted by Leite et al., it was found that the length of stay was a predictor for higher PCFS levels based on multivariate analysis. The increase in length of stay of 1 day was associated with an increased risk of functional status reduction of 17%. In our study conducted at Hasan Sadikin Hospital, Bandung, patients'

average length of stay was 15.25 days, with the shortest being four days and the longest being 44 days having a PCFS scale ranging from 0 to 4.47.

At the beginning of the pandemic, oxygen therapy was the primary choice to overcome the respiratory problems of COVID-19 patients. Patients with severe disease using HFNC tended to have poor functional status. A total of 5 patients had been intubated and 3 patients (60%) had limited functional status up to 4.29 decreased ability to perform daily activities (P < 0.0003).[15]

5. LIMITATIONS

The study was carried out retrospectively so that it depended on the patient's memory and the completeness of the medical record, one of which was the patient's telephone number which sometimes could not be contacted or was not active again. There are few other studies on PCFS to date, so there may be many different characteristics that can be found in this study.

6. CONCLUSION

The assessment of Post-COVID-19 Functional Status is crucial for comprehending the pathophysiology and recovery process of the disease. Evaluating how patients' bodies have responded to and recovered from COVID-19 can provide valuable insights into the long-term effects of the virus on various organ systems. Regular medical check-ups are recommended to monitor organ function and detect any lasting impacts of the infection. Additionally, patients are encouraged to undergo medical rehabilitation to facilitate their return to their pre-COVID functional status. This comprehensive approach ensures that individuals receive the necessary support to fully recover and regain their quality of life.

7. Data availability

Numerical data generated during the conduct of this study is available with the authors, and can be provided on a reasonable request.

8. Acknowledgment

The researchers would like to thank all the staff of the COVID-19 unit at Hasan Sadikin Hospital, Bandung, West Java, Indonesia.

9. Funding

This research did not receive any specific grant from funding agencies in public, commercial, or not-for-profit sectors

10. Conflicts of Interest

The authors declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

11. Authors' contribution

SS: conduction of the study work and manuscript editing

FAR: Concept, conduction of the study work and manuscript editing

12. REFERENCES

1. Beeching JN, Fletcher TE, Fowler R. Coronavirus disease 2019 (COVID-19). BMJ Best Pract. Available from: https://bestpractice.bmj.com/topics/en-gb/3000201

2. Burki T. The origin of SARS-CoV-2. Lancet Infect Dis. 2020;20(9):1018-9. [PubMed] DOI: 10.1016/S1473-3099(20)30641-1

3. Burhan E, Susanto AD, Nasution SA, Isbaniah F, Ginanja E, Pitoyo CW, et al. Pedoman Tatalaksana COVID-19. 3rd ed. Kementerian Kesehatan Republik Indonesia; 2020. Available from: https://www.papdi.or.id/pdfs/983/Buku%20Pedoman%20Tatalaksana%20COVID-19%205OP%20Edisi%203%202020.pdf

4. World Health Organization. Weekly Epidemiological Update on COVID-19; 2021.

5. Sanchez-Ramirez DC, Normand K, Zhaoyun Y, Torres-Castro R. Long-term impact of COVID-19: a systematic review of the literature and meta-analysis. Biomedicines. 2021;9(8):900. [PubMed] DOI: 10.3390/biomedicines9080900

6. Mittal N, Bhadada SK, Katare OP, Garg V. COVID-19: diagnosis and management-Part I. (Mittal N, Bhadada SK, Katare OP, Garg V, eds.). Bentham Sci Publ; 2021.

7. Vaes AW, Goërtz YMJ, Van Herck M, Machado FVC, Meys R, Delbressine JM, et al. Recovery from COVID-19: a sprint or marathon? 6-month follow-up data from online long COVID-19 support group members. ERJ Open Res. 2021;7(2):00141-21. [PubMed] DOI: 10.1183/23120541.00141-2021

8. Daminov BT, Muminov DK. Assessment of the clinical condition of patients in the early rehabilitation period of COVID-19. Br Med J. 2021;1(2). [FreeFullText]

9. Klok FA, Boon GJAM, Barco S, Endres M, Geelhoed JJM, Knauss S, et al. The post-COVID-19 functional status scale: a tool to measure functional status over time after COVID-19. Eur Respir J. 2020;56(1):2001494. [PubMed] DOI: 10.1183/13993003.01494-2020

10. Menges D, Ballouz T, Anagnostopoulos A, Aschmann HE, Domenghino A, Fehr JS, et al. Burden of post-COVID-19 syndrome and implications for healthcare service planning: a population-based cohort study. PLoS One. 2021;16(7):e0254523. [PubMed] DOI: 10.1371/journal.pone.0254523

11. Cuschieri S. The STROBE guidelines. Saudi J Anaesth. 2019;13(5):31. [PubMed] DOI: 10.4103/sja.SJA_543_18

12. Taboada M, Cariñena A, Moreno E, Rodríguez N, Domínguez MJ, Casal A, et al. Post-COVID-19 functional status six-months

after hospitalization. J Infect. 2021;82(4). [PubMed] DOI: 10.1016/j.jinf.2020.12.022

13. Jacobs LG, Gourna Paleoudis E, Lesky-Di Bari D, Nyirenda T, Friedman T, Gupta A, et al. Persistence of symptoms and quality of life at 35 days after hospitalization for COVID-19 infection. PLoS One. 2020;15(12). [PubMed] DOI: 10.1371/journal.pone.0243882

14. Chopra V, Flanders SA, O'Malley M, Malani AN, Prescott HC. Sixty-day outcomes among patients hospitalized with COVID-19. Ann Intern Med. 2021;174(4):576-8. [PubMed] DOI: 10.7326/M20-5661

15. Leite LC, Carvalho L, Queiroz DM, Farias MSQ, Cavalheri V, Edgar DW, et al. Can the post-COVID-19 functional status scale discriminate between patients with different levels of fatigue, quality of life and functional performance? Pulmonology. 2022;28(3):220-3. [PubMed] DOI: 10.1016/j.pulmoe.2022.01.001

16. Mohamed Hussein AA, Saad M, Zayan HE, Abdelsayed M, Moustafa M, Ezzat AR, et al. Post-COVID-19 functional status: relation to age, smoking, hospitalization, and previous comorbidities. Ann Thorac Med. 2021;16(3):260. [PubMed] DOI: 10.4103/atm.atm_606_20

17. Gamal DM, Ibrahim RA, Samaan SF. Post COVID-19 syndrome in a prospective cohort study of Egyptian patients. Egypt Rheumatol Rehabil. 2022;49(1):12. [PMCID] DOI: 10.1186/s43166-021-00104-y

18. Zhou M, Yin Z, Xu J, Wang S, Liao T, Wang K, et al. Inflammatory profiles and clinical features of coronavirus 2019 survivors 3 months after discharge in Wuhan, China. J Infect Dis. 2021;224(9):1473-8. [PubMed] DOI: 10.1093/infdis/jiab181

19. Taboada M, Moreno E, Cariñena A, Rey T, Pita-Romero R, Leal S, et al. Quality of life, functional status, and persistent symptoms after intensive care of COVID-19 patients. Br J Anaesth. 2021;126(3). [PubMed] DOI: 10.1016/j.bja.2020.12.007