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Original Article

Depression, Stress and Anxiety in Patients Recovering from COVID -19 Pneumonia after Hospitalization: Experience at Almoosa Specialist Hospital

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ABSTRACT

Background: The coronavirus disease 2019 [COVID-19] pandemic has created an environment in which many determinants of mental health are affected. Our objective was to determine the prevalence of depression, stress, and anxiety symptoms in adult patients discharged and recovering after hospitalization for COVID -19 pneumonia, at Almoosa Hospital.

Materials and Methods: In a cross-sectional study, the Depression Anxiety Stress Scale 21 [DASS21] assessment instrument was used to measure distress along the three axes of depression, anxiety, and stress and distributed one month after discharge and recovery. Medical records were reviewed to collect information on medical details.

Results: Of the 466 respondents, 53.2% were female, with an average age of 54.20 years. Mental health problems were noted in 130 [27.9%] patients with anxiety symptoms, 79 [17%] with stress symptoms, and 63 [13.5%] with depression symptoms. Patients with mental health problems [depression, anxiety, and stress symptoms] were found to have significantly higher D-dimer levels than patients without these symptoms. The severity of depressive symptoms was found to be significantly associated with decreased oxygen saturation and increased length of stay in the intensive care unit [ICU].

Conclusion: Patients recovering from COVID-19 pneumonia have high rates of mental health problems. Significantly higher D-dimer levels were found in patients with mental health problems. The severity of depressive symptoms was associated with decreased oxygen saturation and increased ICU length of stay. Early recognition and appropriate management of mental health problems are needed.

Keywords: Anxiety; Stress; COVID-19; Emotional Wellbeing; Depression, Saudi Arabia; Mental Health.

INTRODUCTION

The emergence of the 2020 pandemic COVID-19 has increased implications for mental health, both in terms of direct psychological impact and long-term economic and social consequences [1].

Coronavirus disease 2019 [COVID-19] is an infectious illness resulting from severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2] [2]. Most individuals [81%] with COVID-19 experience moderate symptoms [up to mild pneumonia], whereas 14% suffer severe symptoms [dyspnoea, pneumonia, and pulmonary issues in imaging in more than 50% of patients], and 5% develop critical symptoms [pneumonia] [respiratory failure, shock, or multiorgan dysfunction] [3]. Psycho-pathological consequences of coronavirus infection can result directly from viral infection of the CNS or indirectly through an immune reaction [4].

COVID-19 continues to spread throughout most of the world, causing significant health consequences and a high mortality rate in infected individuals. In addition to the direct impact of COVID-19, the pandemic has created an environment in which many mental health factors are also affected. Social restrictions, the difficulty of infection and the lack of medical treatment, the change in daily routine, the news in all media, the decline in economic activity, the news in all media, the fear of disease or death, and government practices of lockdown, curfew, of closing schools and businesses, and the shift in government priorities in its attempt to control the outbreak of COVID-19 all have the potential to increase loneliness, anxiety, depression, insomnia, harmful alcohol and drug use, and self-harm or suicide [5, 6].

The pandemic has caused post-traumatic stress disorder, anxiety, and depression in various populations, including healthcare workers, patients and people in quarantine [7]. The World Health Organization [WHO] reports that at least 30% of COVID-19 patients had psychological problems such as anxiety, depression, post-traumatic stress disorder [PTSD], sleep and memory disturbances, fatigue, and shortness of breath at the time of follow-up [8]. A systematic review of the prevalence of anxiety during the pandemic COVID-19 found that the prevalence of anxiety in the general population was 27.3%, while the prevalence in people infected with COVID-19 was 39.6% [9].

COVID-19 is underreported in some Arab countries. Therefore, measuring the psychological impact may provide some additional information [10]. Numerous studies have been conducted in Arab countries to investigate the incidence of mental illness in COVID-19 patients. According to a study from Dubai, the prevalence of clinically significant anxiety was 21.4%, depression 12.7%, and PTSD 8.7% at 30 days and 9.5%, 7.1%, and 4.7%, respectively, at 60 days [11]. In a study from Saudi Arabia, 50% of patients had depressive symptoms after one month and 33% had panic attacks, which subsided after three months [12].

Mental health services were already overburdened before 2020. According to COVID, 19 pandemic countries took immediate steps to improve mental health support. Telehealth mental health services can help avoid direct physical contact, minimize the risk of transmission COVID -19, maximize available resources, promote good mental health at home, and improve population access to mental health services. These include psychiatric tele-consultations, videoconferencing, and telemedicine for the delivery of cognitive behavioural therapies [13].

THE AIM OF THE STUDY

The purpose of this study was to determine the prevalence of stress, anxiety, and depression symptoms in adult patients admitted to Almoosa Hospital for COVID-19 pneumonia and recovered using the Depression Anxiety Stress Scale 21 and to determine if there was an association with COVID-19 severity of pneumonia, hospitalisation, oxygenation, and inflammatory markers with mental illness symptoms

MATERIALS AND METHODS

Study design:

This was a cross-sectional study of patients who had recovered from COVID-19 pneumonia and were discharged after a hospital stay in either the ward or intensive care unit from May 2020 to May 2021. Sample size: This is a non-proportional random sample in which all patients seen after hospital discharge following recovery from COVID-19 pneumonia were recruited consecutively during this period. The study was conducted at Almoosa Specialist Hospital [ASH], one of the largest private hospitals in the eastern part of the Kingdom of Saudi Arabia with a capacity of 300 beds. The hospital, which during COVID-19 the pandemic had two floors, 40 beds and 20 beds in the intensive care unit with the use of negative pressure ventilation or Hepa filter rooms. Saudi Arabia is the largest country in the Arabian Peninsula with well-developed health care system that is available to all residents free of charge. Ethical approval was obtained from the Institutional Review Board of our hospital [IRB log number: ARC-21.03.1].

Inclusion criteria:

(a) Adult patients [aged 18-70 years] who have contracted COVID-19 pneumonia from May 2020 to May 2021 [confirmed by polymerase chain reaction test [RT-PCR], clinical and radiological signs of consolidation] and have been hospitalized and discharged after recovery from COVID-19 pneumonia.

(b) the patient must have followed up after discharge to our hospital

(c) The patient must have given written informed consent to participate in this study.

(d) All genders and nationalities were included. Mental health was assessed after hospital discharge as part of regular follow-up.

Exclusion criteria:

Subjects who did not meet the inclusion criteria, patients diagnosed with mental illness prior to SARS-CoV-2 infection, patients with impaired cognitive function, or those who could not read and who had not consented to participate in this study were excluded from the study.

Research instrument:

The well-recognized screening tool for symptoms of depression, anxiety, and stress Scale-21 [DASS 21] was used. The DASS 21 questionnaire [Arabic [14, 15] and English [15], depending on the patient's language] was distributed once to patients during their regular follow-up at the pulmonary clinic one month after recovery and discharge from the hospital for COVID -19 pneumonia. Patients who exhibited severe mental health symptoms were referred to the psychiatric clinic for later in-depth evaluation.

The DASS21 is a questionnaire for self-assessment that includes 21 items about three subscales: depression, anxiety, and stress. Each subscale has seven items with four optional scales from 0 [not me] to 3 [applies to me very much or most of the time]. The ratings of these three subscales are determined as sums of values multiplied by two for the respective seven elements [16].

The DASS21 has great advantages and is more reliable than the full DASS. It is shorter and free of problematic questions. Moreover, its latent structure is clearer and more focused. The DASS-21 has recently been used in several studies in other countries as a mental health screening tool in the context of the pandemic COVID-19 and has provided meaningful results [17]. A standard Arabic version of the DASS-21 that can generally be used in all Arab countries, including COVID-19 era [18, 19].

Data collection:

Sociodemographic and clinical data were collected using a structured form. Medical records were reviewed to collect information on medical history, general medical parameters of COVID-19, laboratory values and treatment details. All the patients were diagnosed and treated according to Saudi protocol for the diagnosis and management of suspected or confirmed COVID-19 [20].

Statistical analysis:

It was carried out using the SPSS computer package [IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp., USA]. The Shapiro–Wilk test was used to examine normality of quantitative data. For descriptive statistics: the mean±SD was used for quantitative variables while frequency and percentage was used for qualitative variables. Chi-square or Fisher's exact tests were used to assess the differences in frequency of qualitative variables, while Independent samples t-test or One-Way ANOVA test were used to assess the differences in means of quantitative variables and Mann-Whitney and Kruskal-Wallis tests were used for nonparametric variables. Statistical methods were verified, assuming a significant level of two-sided p values < 0.05.

RESULTS

Of the 466 patients studied, 248 [53.2%] were male, aged 54.0 ± 19.8 years on average [range, 18-70 years], and had a mean BMI of 31.4 ± 8.1 kg/m^2. More than half, 286 [61.4%] of the sample, had comorbid hypertension, and 251 [53.9%] had comorbid type 2 diabetes. Other comorbidities reported were bronchial asthma [9 patients], end-stage renal disease with haemodialysis [7 patients], chronic kidney disease [7 patients], impaired ejection fraction [9 patients], coronary artery disease [15 patients], atrial fibrillation [6 patients], hypothyroidism [12 patients], previous stroke [16 patients], and collagen vascular disease [10 patients]. The most common presenting symptom was cough, followed by fever and shortness of breath. Mental health problems were 130 [27.9%] patients with anxiety symptoms [mild 4.9%, moderate 10.5%, and severe and extremely severe 12.5%], 79 [17%] with stress symptoms [mild 10.7%, and severe and extremely severe 6.2%], and 63 [13.5%] with depression symptoms [mild 5.4%, moderate 6.9%, and severe and extremely severe 1.3%]. The percentage of participants who completed the DASS-21 survey in Arabic and English was 98.1% and 1.9%, respectively. [Table 1]

The average length of inpatient stays was 9.7 ± 7.2 days. About 29.2% of patients required admission to the ICU, and the average length of stay in the ICU was 13.2 ± 11.8 days. The average time from recovery to the start of the investigation was 33.8±13.6 days. During hospitalization, the majority of patients [94.6%] required oxygen therapy, mainly via nasal cannula [46.6%], and approximately 14.6% required mechanical ventilation. About 79.3% received systemic steroids, and laboratory results for the mean inflammatory markers are shown in Table [2].

The univariate analysis in table [3] compared several demographic and clinical variables between those with and without any mental health problems. There were no significant differences in demographic or clinical characteristics associated with mental health problems, except for the mean length of ICU stay, which was significantly increased in patients with depression symptoms. Patients with mental health problems [depression, anxiety, and stress symptoms] were found to have significantly higher D-dimer levels than patients without these symptoms.

Age, steroid treatment, and partial pressure of arterial

oxygen tension [PaO2] showed no significant differences between the expressions of anxiety, stress, or depression symptoms. The severity of depressive symptoms was found to be significantly associated with decreased oxygen saturation and increased ICU length of stay. Also, severity of anxiety symptoms was significantly associated with decreased oxygen saturation. [Table 4].

Table [1]: Basic characteristics of the studied sample.

Characteristics		n=466 [%]
Sex	Male Female	248 [53.2] 218 [46.8]
Comorbidity [1]	Type 2 diabetes Essential Hypertension Bronchial asthma Other comorbidities	251 [53.9] 286 [61.4] 9 [1.9] 82 [17.6]
Symptoms and signs at clinical presentation	Fever Cough Shortness of breath	410 [88.0] 428 [91.8] 362 [77.7]
Depression	No depression Mild depression Moderate depression Severe depression Extremely severe depression	403 [86.5] 25 [5.4] 32 [6.9] 4 [0.9] 2 [0.4]
Anxiety	No Mild anxiety Moderate anxiety Severe anxiety Extremely severe anxiety	336 [72.1] 23 [4.9] 49 [10.5] 40 [8.6] 18 [3.9]
Stress	No stress Mild stress Moderate stress Severe stress Extremely severe stress	387 [83.0] 50 [10.7] 20 [4.3] 9 [1.9] 0[0.0%]
Oxygen saturation %		88.0 ± 10.1
Age [years]	Mean±SD Min.-Max.	54.0 ± 19.8 [18 – 70]
BMI [kg/m^2]	Mean±SD	31.4 ± 8.1
Nationality	Saudi Arab non-Saudi Non-Arabic	417 [89.5] 40 [8.6] 9 [1.9]

[1]: Some patients have more than one comorbid condition. BMI: body mass index

Table [2]: Overall patient outcome and interventions.

Characteristics		n=466 [%]
Admission to the ICU		136 [29.2]
Patients required oxygen therapy		441 [94.6]
Type of oxygen therapy	Nasal cannula Mechanical ventilation Face mask Non-rebreathing mask High flow nasal cannula Bi-level positive airway pressure No	217 [46.6] 68 [14.6] 63 [13.5] 49 [10.5] 39 [8.4] 5 [1.1] 25 [5.4]
Systemic corticosteroids		370 [79.3]
Laboratory results for inflammatory markers	Serum ferritin [ng/mL] C-reactive protein [mg/dL] LDH [U/L] D-dimer [nmol/L]	2799.96±7705.32 130.35 ± 142.68 655.20 ± 1364.49 6.87 ± 47.87
Duration of stay in the ward [days]		9.7 ± 7.2
Duration of stay in the ICU [days]		13.2 ± 11.8
The time from recovery to evaluation [days]		33.8 ± 13.6

Mg/dl: milligrams per decilitre, nmol/L: Nanomoles per litre, U/L: Units/Litre

Table [3]: Univariate analysis of patient characteristics vs. depression, anxiety, and stress [n = 466].

Characteristics	Depression/ No depression	Anxiety/ No anxiety	Stress/ No Stress
Sex [*Female*]	30 [47.6]/188 [46.7]	57 [43.8]/161 [47.9]	40 [50.6]/178 [46.0]
P-value	0.886	0.430	0.452
Essential Hypertension	37 [58.7]/249 [61.8]	80 [61.5]/206 [61.3]	51 [64.6]/235 [60.7]
P-value	0.643	0.964	0.524
Type 2 diabetes	30 [47.6]/221 [54.8]	69 [53.1]/182 [54.2]	43 [54.4]/208 [53.7]
P-value	0.285	0.832	0.912
Asthma	1 [1.6]/8 [2.0]	3 [2.3]/6 [1.8]	1 [1.3]/8 [2.1]
P-value	0.831	0.713	0.637
Oxygen therapy	62 [98.4]/379 [94.0]	125 [96.2]/316 [94.0]	77 [97.5]/364 [94.1]
P-value	0.152	0.365	0.220
Admission to the ICU	20 [31.7]/116 [28.8]	43 [33.1]/93 [27.7]	23 [29.1]/113 [29.2]
P-value	0.631	0.250	0.988
Duration of stay in ICU [days]	21.12 ± 10.45/ 13.82 ± 12.05	12.46 ± 11.02/ 14.44 ± 12.61	11.68 ± 9.39/ 13.49 ± 12.26
P-value	0.006*	0.347	0.515
The time from recovery [days]	31.71 ± 14.05/ 34.39 ±13.5	34.33 ± 13.54/ 33.28 ± 13.77	32.31 ± 13.7/ 34.13 ± 13.63
P-value	0.086	0.411	0.297
Age [years]	54.65 ± 15.55/53.86 ± 20.41	53.85 ± 17.74/54.01 ± 20.56	56.68 ± 15.24/53.41 ± 20.59
P-value	0.769	0.937	0.182
Inflammatory markers			
Serum ferritin [ng/mL]	3900.6±1044.3/ 2626.8±7271.3	3571.01±1027.59/ 2505.28 ± 6453.26	3358.45± 8878.65/ 2681.39±7441.09
P-value	0.238	0.198	0.487
C-reactive protein [mg/dL]	118.3±85.7/ 132.4 ± 150.11	147.4±221.3/ 123.55± 94.45	134.17 ± 94.46/ 129.53 ± 151.05
P-value	0.469	0.114	0.796
Serum lactate dehydrogenase [U/L]	838.94 ± 2288.06/ 627.48 ± 1166.61	546.43 ± 611.39/ 698.09 ± 156.79	765.91 ± 201.60/ 632.58 ± 119.11
P-value	0.303	0.324	0.470
D-dimer [nmol/L]	28.73 ± 13.53/ 3.93 ± 1.53	15.46 ± 86.85/ 3.18 ± 4.39	21.93 ± 11.82/ 3.89 ± 1.75
P-value	<0.001*	0.010*	<0.001*

Values present as number and % were analysed by Fisher exact test. Values present as mean ± SD were analysed by Independent samples or Mann-Whitney tests. *: Significant. Mg/dl: milligrams per decilitre, nmol/L: Nanomoles per litre, U/L: Units/Litre

Table [4]: Relation between degree of anxiety, stress, and depression with age, steroid treatment, oxygen saturation, partial pressure of arterial oxygen tension [PaO_2], and duration of ICU stay among the studied patients

Variables		Degree					P-value
		Normal	**Mild**	**Moderate**	**Severe**	**Very severe**	
Age [years]	**Anxiety**	52.2 ± 17.7 [13-100]	53.3 ± 15.7 [30-98]	54.1 ± 18.0 [1.5-90]	53.7 ± 17.1 [28-84]	54.2 ± 16.0 [12-96]	0.882
	Stress	53.3 ± 16.4 [13-92]	52.9 ± 19.6 [1.5-100]	-	56.7 ± 17.6 [18-89]	51.9 ± 16.5 [12-96]	0.649
	Depression	53.4 ± 17.1 [13-100]	52.9 ± 16.7 [1.5-96]	51.8 ± 18.1 [12-86]	57.6 ± 15.4 [30-88]	54.1 ± 15.7 [19-89]	0.806
Steroid treatment	**Anxiety**	271 [73.2]	17 [4.6]	37 [10.0]	30 [8.1]	15 [4.1]	0.764
	Stress	300 [81.1]	45 [12.2]	-	17 [4.6]	8 [2.2]	0.161
	Depression	324 [87.6]	18 [4.9]	22 [5.9]	4 [1.1]	2 [0.5]	0.302
Oxygen saturation	**Anxiety**	90.7 ± 9.3	87.9 ± 13.8	86.4 ± 8.6	85.1 ± 6.2	84.9 ± 9.9	<0.001*
	Stress	87.7 ± 10.4	87.8 ± 11.4	-	89.3 ± 9.7	90.1 ± 4.9	0.478
	Depression	91.7 ± 7.5	89.9 ± 10.8	86.4 ± 9.1	84.4 ± 9.3	85.4 ± 7.2	0.001*
PaO2	**Anxiety**	63.7± 13.2	62.8 ± 9.8	64.1 ± 11.0	61.7 ± 9.2	63.0 ± 10.7	0.874
	Stress	63.1 ± 11.6	65.1 ± 11.3	-	61.9 ± 9.1	64.6 ± 11.7	0.461
	Depression	63.3 ± 11.7	63.7 ± 10.2	63.3 ± 11.5	62.7 ± 15.3	63.4 ± 8.9	0.998
Duration of ICU stay [d]	**Anxiety**	14.7 ± 13.8	13.9 ± 10.6	12.6 ± 11.8	12.4 ± 3.2	12.4 ± 11.3	0.919
	Stress	12.8 ± 11.9	16.8 ± 13.8	-	9.4 ± 9.1	14.0 ± 9.5	0.373
	Depression	13.4 ± 11.5	15.7 ± 14.4	17.3 ± 3.7	31.0 ± 29.1	21.8 ± 5.8	0.025*

Values presented as number and % [percent within the raw] were analysed by Chi-square test. Values present as mean ± SD were analysed by One-Way ANOVA or Kruskal-Wallis tests. *: Significant. PaO_2: Partial pressure of arterial oxygen tension, ICU: Intensive care unit.

DISCUSSION

The relationship between COVID-19 and mental symptoms is of great concern. There are several potential explanations, including viral infection of the brain, microvascular thrombosis, neuroinflammation, neuro-degeneration, a disruption of the blood–brain barrier, peripheral immune cell infiltration, impaired neuro-transmission, and severe inflammatory conditions are the most common conditions [21-23].

In addition, social factors such as social isolation, the psychological impact of a new serious illness, concern about infecting others, and stigma are possible explanations. As a result, pre-existing neuro-psychiatric syndromes reappear or worsen [23, 25].

In the current work, 61% of the participants had comorbid hypertension and 54% had comorbid type 2 diabetes. This is consistent with the findings of Taquet *et al*. who reported that the most common comorbid conditions were hypertension [38.7%] and diabetes mellitus [31.1%] [26].

In this study, symptoms of anxiety, depression, and stress were reported in 49%, [18%, 14%, and 17% respectively]. World Health Organization [WHO] reports that at least 30% of COVID-19 patients suffer from psychological problems such as anxiety, depression, post-traumatic stress disorder, insomnia and fatigue [8].

Rogers *et al*. performed a systematic review and meta-analysis and found that approximately 30-40% of patients with COVID-19 reported clinically significant anxiety and depression [27].

Deng *et al*. conducted a meta-analysis to assess the prevalence of depression and anxiety in COVID-19 patients. They found that 45% of patients suffered from depression and 47% from anxiety [28].

Nalbandian *et al*. conducted a systematic review of post-acute COVID-19 syndrome and reported that anxiety, depression, PTSD, and sleep disturbances were found in 30-40% of COVID-19 survivors [29].

Saudi researchers assessed the psychological and mental health of isolated hospitalized patients with suspected or confirmed COVID -19 [52 patients] and reported borderline or abnormal scores for depression 38.4% and anxiety 17.3% [12]. Another Saudi study on the mental health of COVID -19 patients found that 13% of COVID -19 patients had borderline anxiety, 26.8% were classified as anxiety patients, 29.9% had borderline depression, and 18.4% were classified as depressed patients [30].

In a study conducted in the United Arab Emirates, depression rates ranged from 12.5% to 28.6%, and pre-existing chronic conditions were associated with depression [31].

The prevalence of clinically significant anxiety was 21.4%, depression 12.7%, and PTSD 8.7% among 103 patients [96% were migrant workers in Dubai] at day 30 and 9.5%, 7.1%, and 4.7%, respectively, at day 60 [11].

Regarding neuropsychiatric symptoms of post-COVID -19 syndrome in Egyptian health care workers, about half of them suffered from depressive symptoms after 1 month and about one third suffered from panic attacks after 3 months, which then decreased [32].

In a study from China, the prevalence of clinically significant stress was reported to be 31%, anxiety 22.2%, and depression 38.1%, with no statistically significant differences in the prevalence rate of mental disorders according to the severity of COVID -19 patients [33].

Another study in China found that at least 25% of COVID -19 patients suffered from anxiety, insomnia, and depression within 6 months [34]. Another study from China found that the pooled prevalence of depression was 45% and anxiety 47% in COVID -19 patients [35].

The majority [56%] of COVID -19 survivors in Italy showed positive outcomes in at least one domain [depression, anxiety, posttraumatic stress disorder, and insomnia] one month after hospitalization [36]. An Iranian study reported that COVID -19 survivors had high levels of anxiety [43.1%], severe stress [32.4%], and depression [12.8%] [37].

According to the Bangladesh study [38], anxiety symptoms were prevalent in 57.2% and depression symptoms in 52.2%. Nevertheless, the Korean study did not find a correlation between psychiatric disorders and COVID-19 infection, albeit with a smaller sample size and lower concordance [39].

In this study, it was found that men were more likely to suffer from depression than women, but not significantly more likely. According to Tawfik et al. Men are slightly more likely to suffer from depression than women [32]. However, Hurissi *et al*. [40], Mazza *et al*. [36], Li *et al*. [41], Wu *et al*. [42], and Beck et al [43] found that women with COVID -19 suffered from anxiety and depression more often than men.

In this study, a significant association was found between decreased oxygen saturation and severity of depressive symptoms. This is consistent with previous studies, where patients with oxygen saturation less than 93% at rest were more likely to have depression [38, 44]. This contrasts with Mazza et al. who reported the same result and indicated that psychiatric symptoms are independent of physical findings [36].

This study found a significant increase in blood D-dimer levels in patients who developed depression, stress, and anxiety. Several studies have found no association between inflammatory markers at baseline and depression, anxiety, insomnia, or PTSD. However, systemic immune inflammation index [SII] at baseline was positively associated with anxiety and depression,

suggesting that psychiatric symptoms were not due to physical illness [36, 45].

Many studies have reported that COVID -19 patients with high D-dimer levels are at increased risk for serious illness and mortality and that no single cut-off value has been defined to predict adverse events. Measurement accuracy and reliability may vary depending on the kits used for measurement and the reporting units [46, 47].

In this study, a significant association was found between the length of stay in the ICU and the severity of depressive symptoms. Numerous studies have associated length of hospital stay with mental health problems, but this factor does not appear to be a risk factor for mental health problems in COVID-19 patients [38, 48, 49].

Length of hospital stay was significantly correlated with depression, anxiety, and stress, according to Salimi *et al*. [37]. In contrast to Mazza *et al*. [36] and Beck *et al*. [43], these results did not find a correlation between mental health problems and ICU stay after COVID-19.

Study limitations:

A single cross-section without follow-up and the small size of the study population, as well as socioeconomic status and demographic differences, were not considered in the study. These are limitations of this study that should be considered when interpreting the results.

Conclusions:

Patients recovering from COVID-19 pneumonia have high rates of mental disorders. Prolonged ICU stays and decreased oxygen saturation were associated with high rates of depressive symptoms, and elevated level of the inflammatory marker D-dimer was associated with depression and anxiety symptoms.

Mental health screening with standardized tools is necessary at an early stage in COVID-19 patients to improve their outcome and quality of life. Future multicentre trial using standardized tools and a mental health assessment of COVID-19 patients at the time of diagnosis is needed.

Availability of data and materials:

The datasets used in the current study are available from the corresponding author on reasonable request.

Declarations:

Ethics approval and consent to participate:

Ethical approval was obtained from the Institutional Review Board of our hospital [IRB log number: ARC-21.03.1].

Consent: Patient's written consent was taken.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: SE and SO wrote the first draft of the manuscript and critically reviewed and revised the manuscript. GA analysed and interpreted the patient data. All author's read and approved the final paper

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