Original Article

Assessment of the Functional Recovery and Stress in ICU Survivor Patients with Acute Respiratory Distress Syndrome Due to Covid-19

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Abstract
Introduction: The long-term consequences of hospitalization in the ICU with Acute Respiratory Distress Syndrome (ARDS) due to COVID-19 have been the subject of study, since a large number of patients after hospital discharge develops complications on physical, psychological and functional condition.
Aim: The investigation of the functional recovery and stress in ICU patients with ARDS due to COVID-19.
Methods: This is a cross-sectional study recording data of patients assessed in the ICU. All patients participated in a follow-up program in the first and third, after ICU and hospital discharge. The Hospital Anxiety and Depression Scale (HADS) and the Barthel Index were used. The statistical package SPSS ver.24 was used to analyze the results. The level of significance was set at p<0.05.
Results: The study involved 39 patients of which 76.9% were male and the age range was from 25 to 76 years. All patients had COVID-19 and none had a cardiac arrest in the ICU during their hospitalization. During the first month follow-up, 53.8% reported dependence in completing activities of daily living, while 53.6% reported dependence during the third month of follow-up. This difference was not statistically significant between the first and third month of follow-up (p<0.05). The mean HADS depression score did not change statistically significantly (P<0.05) between these follow-ups. Similar result was observed for the mean score of the HADS anxiety scale respectively.
Conclusions: The Barthel index score does not seem to increase significantly in patients with ARDS due to COVID-19. The HADS scale for both patient depression and anxiety did not show a significant decrease between the two follow-up periods.

Key words: ARDS, SARS-CoV-2, ICU, Follow up, Pulmonary function

Introduction

The SARS-COV-2 virus, which broke out in late 2019 in China, is now known to attack the respiratory system, creating diversity in the severity of the disease (Krynytska et al., 2021). Although most patients are mildly symptomatic, a significant percentage (15-30%) will develop severe pneumonia with severe respiratory distress (ARDS), with increased chances of intubation and mechanical ventilatory support (Ko RE et al., 2019).

ARDS according to recent studies seems to affect the quality of life of patients compared to the average population and to improve at a very slow rate or even to never fully return to pre-admission levels (Bein T et al.,2019). The basic therapeutic techniques used in an ICU to treat this disease can cause significant physical, mental and cognitive disorders, which significantly affect the quality of life after discharge from the hospital. Indicative effects of the disease are increased mortality, post-traumatic stress disorder (24%), anxiety (42%), depression (36%) and functional disability (50%), (Brown SM et al., 2017) and may also include sexual dysfunction, amnesia of the ICU period and various related social problems (Oliveira RP et al., 2019). However, there seems to be a gap at the level of studies, taking into account the minimal data available in the literature, as the concept of post-hospital follow-up of patients is a topic that has recently been developed, especially in the Greek scientific community. (Jessica A et al., 2021).

According to the above, it is understandable that there is a further need to conduct results that would help to record and categorize these consequences, in order to differentiate the scientific practice in place within ICUs and minimize these complications after hospitalization (Wilcox M et al., 2013). It is also important to set up post-hospital follow-up structures and to establish follow-up protocols to avoid hospital readmissions, thus saving resources. Overall, the above would promote optimal recovery of the patient after hospitalization and maximum recovery of optimal quality of life (Hopkins RO et al., 2005)

The aim of the study was to investigate depression, anxiety and functional independence in the areas of personal care and mobility of patients hospitalized in an ICU with Acute Respiratory Distress Syndrome due to Covid-19.

Methods

The study was conducted at the Athens General Hospital "Sotiria" and included 39 patients with Acute Respiratory Distress Syndrome due to Covid-19. The sample collection period was from 1/1/2021 to 31/12/2021. The sample consisted of surviving ARDS patients. The criteria for patient participation in the study were:

Inclusion criteria
1.   Adult patients >18 years old.
2.   Survivors with diagnosed ARDS due to Covid-19.
3.   Survivors on mechanical ventilation during hospitalization.
4.   Surviving patients with verbal communication ability.
5.   Survivors with satisfactory reading and writing skills in the Greek language.

Exclusion criteria
1.   Survivors who do not speak the Greek language.
2.   Surviving patients with no possibility of verbal communication.
3.   Survivors with psychiatric disorders

All patients were followed up in the first and third month after admission to the ICU. Participants were informed of both the purpose and nature of the study and the confidentiality of their personal data. The participation in the study was subject to their written informed consent. For the present study the Hospital Anxiety and Depression Scale (HADS) questionnaire in its translation and validation in the Greek language was used (Mitsopoulos, et al., 2008), The questionnaire assesses anxiety and depression. The Barthel scale, which assesses the patient's functional independence and its version in the Greek language was used (Theofanidis, 2016).

Statistical analysis: The processing and analysis of the results was carried out with the statistical package SPSS ver.24. The Mean Value, the Standard Deviation and the range were used to describe the quantitative variables, while absolute (n) and relative frequencies (%) were used to describe the qualitative variables. The test of normality of the data was carried out with the Shapiro Wilk's statistical test. To investigate the

correlation between two quantitative variables, Pearson's correlation coefficient was used parametrically and Spearman's correlation coefficient was used non-parametrically. Pearson's statistical criterion was used to investigate the relationship between two qualitative covariates. In the case where the conditions for applying the test did not apply, Fisher's and Monte Carlo's test was used. The comparison between a quantitative variable and a qualitative one with two levels was performed using parametric Student's t-test and non-parametric Mann-Whitney U test. The comparison between a quantitative variable and a qualitative variable with three levels or more was carried out using parametric ANOVA and non-parametric Kruskal Wallis test. All tests were performed at the 0.05 level of significance.

Ethics: The study has been approved by the Research Ethics Committee of the University of West Attica (protocol number 775/07-01-2021). The research was conducted in accordance with the principles of the Declaration of Helsinki.

Results

The demographic and clinical characteristics of the sample are presented in Table 1. The patient group consisted of 39 patients with an average age of 59.62 years, who were hospitalized at the Athens General Hospital "Sotiria" with Acute Respiratory Distress Syndrome. The majority of the patients (76.9%, n=30) were male, all patients were suffering from Covid-19 and none of them had a cardiac arrest in the ICU during their hospitalization. The mean length of stay of the patients in the ICU was 14.97 days and none were readmitted. The mean scores for the HADS scale and the Barthel scale are presented in Table 2 for the first and third month of follow-up.

The mean score for the HADS scale at the first month of patient follow-up was 9.9 points and at the third month of follow-up was 8.67

points, the above decrease did not show a statistically significant difference (p>0.05) between the two measurements. 69.2% (n=27) and 74.4% (n=29) showed normal levels of anxiety and depression during the first month of follow-up while during the third month of follow-up the normal levels increased in both scales without any statistically significant difference (p>0.05). The Barthel scale score showed an increase in the third month of follow-up. Only one person claimed complete dependence in the first month of follow-up while none in the third month. In contrast, at the first month of follow-up 53.8% (n=21) of patients reported dependence in relation to completing activities of daily living while 43.6% (n=17) reported dependence at the third month of follow-up. This difference did not appear statistically significant between the first and third month of follow-up (p>0.05).

Patients with tertiary education had a higher rate of anxiety than secondary education patients (p=0.015) during the first month of follow-up, while there was no statistically significant difference in depression levels in relation to education level. At the third month of follow-up, patients' occupation differed in depression levels. In particular, civil servants had a higher rate of depression compared to patients with other occupations. Those patients who were reintubated showed statistically significantly (p<0.05) lower rates of anxiety and depression compared to patients who were not reintubated (Table 3). Other demographic and clinical characteristics did not appear to differ in the rates of anxiety and depression in patients.

Patients who were not tracheotomized had statistically significantly (p<0.05) higher scores on the Barthel scale than patients who were not tracheotomized at both months of follow-up (Table 4). No other demographic or clinical characteristics appeared to differ in Barthel scale scores at either the first or third month of follow-up.

Table 1. Demographic and clinical characteristics of the sample (n=39)

Age	59.62±11.01
Sex	
Male	30 (76.9%)
Female	9 (23.1%)
Family Status	
Married	31 (79.5%)
Unmarried	4 (10.3%)
Divorced	2 (5.1%)
Widower	2 (5.1%)
Educational level	
Secondary	18 (46.2%)
Tertiary	21 (53.8%)
Profession	
State employee	3 (7.7%)
Private employee	11 (28.2%)
Freelance	9 (23.1%)
Retired	16 (41%)
Number of people living with you	
None	8 (20.5%)
1-2 people	23 (59%)
From 3 people and more	8 (20.5%)
LOS in ICU	14.97±13.88
Days in mechanical ventilation	9.44±8.99
Days on automatic respiration	5.13±7.22
Total hospital stay in days	25.13±14.36
Reintubation	
No	34 (87.2%)
Yes	5 (12.8%)
Tracheotomy	
No	35 (89.7%)
Yes	4 (10.3%)

Table 2. Comparisons of scales in the 1st month and 3rd month

	1st month	3rd month	P
HADS	9.90±7.18	8.67±6.82	0.420
HADS-A Anxiety			
Normal levels	27 (69.2%)	29 (74.4%)	0.599
Borderline problem	6 (15.4%)	7 (17.9%)	
Serious problem	6 (15.4%)	3 (7.7%)	
HADS-D Dipression			
Normal levels	29 (74.4%)	31 (79.5%)	0.908
Borderline problem	8 (20.5%)	6 (15.4%)	
Serious problem	2 (5.1%)	2 (5.1%)	
Barthel scale score	88.59±18.21	92.05±13.61	0.338
Barthel scale assessment			
Full dependence	1 (2.6%)	0 (0%)	0.862
Severe dependence	2 (5.1%)	2 (5.1%)	
Moderate dependence	10 (25.6%)	7 (17.9%)	
Mild dependence	8 (20.5%)	8 (20.5%)	
Independence	18 (46.2%)	22 (56.4%)	

Table 3. Comparisons of patient characteristics with the HADS-A and HADS-D scales.

		1st month			
		HADS-A Anxiety	p	HADS-D Depression	p
Educational level	Secondary	3.17±3.24	0.015	4.72±3.46	0.835
	Tertiary	6.43±4.60		5.19±4.03	
		3rd month			
		HADS-A Anxiety	p	HADS-D Dipression	p
Profession	State employee	9.33±4.16	0.127	9.00±1.00	0.046
	Private employee	3.64±3.01		3.09±2.88	
	Freelance	4.00±3.74		3.11±3.30	
	Retired	4.75±3.26		4.31±3.95	
Reintubation	No	5.03±3.56	0.049	4.47±3.69	0.039
	Yes	1.80±0.79		1.20±0.84	

Table 4. Comparisons of patient characteristics with the Barthel scale.

		1st month		3rd month	
		Barthel scale	p	Barthel scale	p
Tracheotomy	No	91.71±15.48	0.001	93.24±12.24	0.002
	Yes	61.25±19.31		84.00±20.74	

Discussion

Complications in ARDS patients with COVID-19 after ICU hospitalization have been reported in the international literature during the pandemic outbreak. Our study focused on recording survivors' anxiety and depression, and functional recovery at the level of personal care after hospital discharge.

The results showed that 15.4% of patients had severe anxiety in the first month of discharge from the hospital, a percentage that had a downward trend in the third month, however, there was no statistically significant decrease. The lapse of time as well as the reintegration of the patient into his family environment obviously helps at the reduction of anxiety and the improvement of his psychological state. However, severe depression appeared to be present in 5.1% of patients at the first month assessment, a percentage that did not change at the third month assessment. It is likely that this is observed in patients who were showing signs of depressive assistance before the hospital admission. An important finding of the study was that the level of education of the patients had a statistically significant relationship with anxiety.

That is, it was observed that tertiary education patients had a higher rate of anxiety than secondary education patients in the first month of follow-up, and that civil servants had a higher rate of depression compared to patients with other occupations. The possible explanation for this result is interpreted by the fact that patients with higher educational level have more access to information, so they could be informed about the possible complications of their condition, which would cause them more anxiety. Also, the need to recover more quickly in order to return as soon as possible to their jobs, which may have carried more responsibility, acted as a burden. However, the association between depression and working in the public sector seems paradoxical, as this category of employees is characterized by job stability and, on average, non-stressful working conditions compared to the rest of the workforce. Also, a noteworthy finding was that those patients who were reintubated showed statistically significantly lower rates of anxiety and depression than patients who were not reintubated, which is justified by the increased health severity, which does not allow for full mental and emotional clarity of these patients.

Regarding the degree of dependency in functional independence in personal care and mobility, in the first month 46.2% of patients declared full independence, while in the third month full independence was recorded in 56.4% of patients, with an obvious upward trend, but to a statistically insignificant degree. This is of course explained by the fact that between the first and third month the patient regains muscle capacity, is clearly better nourished and has access to services that promote stimulation, such as physiotherapy. Patients who were not tracheotomized showed statistically significantly higher scores on the Barthel scale compared to patients who were not tracheotomized at both months of follow-up, a finding that is to be expected, as tracheostomy is an invasive procedure in critically ill patients, requiring more complex hospital conditions, and are more likely to be infected, which can prolong their hospital stay.

Experience so far from previous published studies shows that patients who have experienced Acute Respiratory Distress Syndrome experience significant problems regarding their psychological state and their functionality in personal care upon returning home. In particular, in a study conducted in an Intensive Care Unit of a hospital in France by Laurent et al, among 44 patients, it was observed that 48% of patients were recorded with symptoms of severe anxiety, while 23% of patients had a depressive episode at follow-

up, but no differences were reported according to the level of education of the patients or their type of work. In addition, 63% of patients reported persistent fatigue that affected their daily basic activities (Laurent R et al., 2023). Similar results from 49 patients who completed their hospitalization in the ICU of a New York City hospital, of whom 35.6% reported problems with personal self-care and 66.6% reported problems with basic daily activities. These results did not record whether patients had undergone tracheotomy or had been reintubated. Also, 37.8% of these patients were recorded with severe symptoms of anxiety or depression and 4.4% reported extreme anxious or depression (Martillo A et al., 2019). In a study conducted in 2022 by Martinez et al., (2023) in Buenos Aires on 40 patients discharged from the ICU, the follow-up results showed that 64% had functional dependence, while 32% had mental disorders involving anxiety or depression

Similarities in methodology and results were also observed in a study by Chommeloux et al in an ICU in France, where in a sample of 62 patients, 44% reported significantly increased anxiety, 42% were recorded with symptoms of depression, and overall quality of life seemed to be affected during the follow-up period, according to the recording scales completed (Chommeloux et al., 2023).

Thus, we notice that very recent studies come to similar results to our research, in relation with the comparing population. However, none of them documented an association relating educational level to the degree of anxiety/depression, nor did they report tracheostomy as an indicator of worse self-care at home. It is important to mention that in all the included studies, the follow-up included different assessment parameters concerning the physical condition of the patients in terms of stamina and functionality, the recovery of lung function confirmed by imaging examinations, psychological as well as cognitive parameters, and the overall recovery of the patient's quality of life, in relation to the recovery of the previous state before being affected by this syndrome. Also, there was variation in the time of follow-up from study to study.

This study has several limitations that should be mentioned. It is important to emphasize that no significant findings from Asian and Latin American countries were published, which makes it difficult to obtain valid scientific results. Moreover, among the studies used there was diversity in terms of the instruments included, which nevertheless recorded similar parameters. Another limitation is that there was no consistency in the timing of follow-up, which raises concerns about the reliability of the results. Also, all studies emphasized that a large proportion of patients did not wish to participate in the follow-up so that large sample losses were recorded, which is confirmed by our study. Although the Covid-19 pandemic has succeeded in turning the majority of the scientific community in this direction, data on the long-term effects of the disease are still incomplete. Therefore, due to these limitations, there is still a need for more research, especially on the follow-up of those patients who managed to survive this disease, on a larger scale and duration, as the Covid-19 epidemic is particularly recent, so the complications ought to be investigated prospectively in the coming years.

Conclusions: It is a fact that Covid-19 infection can lead to severe Respiratory Failure, which requires prolonged hospitalization in the Intensive Care Unit, with prolonged mechanical ventilation. The majority of studies published internationally focus on the long-term outcomes of this disease in survivors, investigating different aspects of this disease, such as physical, cognitive and psychological. The intense psychological burden due to anxiety or even depression after such a major suffering, but also the functionality in terms of personal care and hygiene of these patients after hospital discharge, remains at the top of the pyramid of the interest, and certainly needs further research to draw more valid results and conclusions. It is important to study all these above-mentioned issues deeply and to generate new research concerns in order to be able to describe more comprehensively the real needs of these patients after their ICU stay.

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