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Comparison of Post-Intensive Care Syndrome between Patients with and without COVID-19 who had Non-Invasive Mechanical Ventilation Support in the Intensive Care Unit

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ABSTRACT

Introduction: Post-intensive care syndrome (PICS) is defined as "new or deteriorating physical, cognitive, or mental health state after intensive care". This study compared patients with and without a diagnosis of coronavirus disease-2019 (COVID-19) who received non-invasive mechanical ventilation support in the intensive care unit and were monitored for the onset of PICS.

Methods: Retrospective imaging was performed on 50 COVID-positive and 50 non-COVID patients who were over 18 years of age and receiving non-invasive mechanical ventilation. The Mini Mental State test, Beck Depression test, Beck Anxiety test, and Post-Traumatic Stress Disorder test were administered to the patients to evaluate cognitive and psychiatric functioning after contacting them via the hospital system and obtaining the required consents.

Results: Patients with COVID had longer stays in the ICU ($p<0.001$). Patients with COVID were observed to have a more severe depression than patients without COVID ($p=0.019$). Patients with COVID had a higher percentage of moderate and severe anxiety than those without COVID ($p=0.003$). Patients with COVID had a greater incidence of PTSD ($p=0.025$). Although COVID patients were more likely to have severe cognitive dysfunction than non-COVID patients, the difference was not statistically significant ($p=0.184$). Physical dysfunction was significantly higher in the COVID group than in the non-COVID group ($p=0.019$). Longer stays in the ICU were found in patients who had PICS ($p=0.008$).

Conclusion: When we examined the patient groups with and without a diagnosis of COVID, we concluded that PICS is more prevalent among COVID patients receiving non-invasive mechanical ventilator support.

Keywords: Intensive care, anesthesia, COVID-19, post-intensive care syndrome

Introduction

It is now recognized that post-intensive care syndrome (PICS) can have harmful effects on patients' lives, particularly on health-related quality of life. The majority of clinicians who have studied the subject define "PICS" in the literature as "new or worsening physical, cognitive, or mental health state after intensive care" (1). Treatment and care for these patients continue even after discharge. On the other hand, PICS excludes patients with primary nerve injuries, such as traumatic brain damage or cerebrovascular accidents, who are admitted to the intensive care unit (2).

The risk factors associated with the formation of PICS are not well understood, and different studies have identified different risk variables. Risk factors can be broken down into two groups when looked at generally. The first category includes elements such as pre-existing neurological and neuromuscular conditions. The second is the presence of acute respiratory distress syndrome (ARDS), sepsis, dysglycemia, delirium, dose of sedative provided, and other significant comorbidities associated with the critical care unit (3).

In addition, because of improvements in medical technology, a larger percentage of patients are now being released from intensive care units. There are numerous comorbidities because of this growth. After a severe illness, 25% of survivors are believed to experience cognitive impairment on average. The most frequently reported psychiatric problems are Post-Traumatic Stress Disorder (PTSD), depression, and anxiety (4). Numerous PICS symptoms and indicators can linger for months, although healing is feasible (5). Therefore, it is crucial to diagnose PICS early in patients and begin appropriate therapy to lower mortality, morbidity, health care expenses, and workforce loss.

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The goal of this research was to compare the development of PICS in patients with and without a diagnosis of COVID-19 who were followed up with non-invasive mechanical ventilation support in the intensive care unit.

Methods

Following approval from the Erzincan Binali Yıldırım University Local Ethics Committee (approval number: 08/07, date: 21.06.2021), the files of 100 patients (50 COVID positive and 50 non-COVID), over the age of 18, who were followed up on and discharged from our anesthesiology and reanimation intensive care unit with non-invasive mechanical ventilation between April 1, 2020 and May 1, 2021 were retrospectively scanned. The patient files contained information regarding anamnesis, physical examination, length of stay in the intensive care unit, and treatment administered. This study excluded patients with traumatic brain injury, cerebrovascular disease, previous neuropsychiatric disease, and invasive mechanical ventilation support.

This manuscript adhere to the applicable STROBE guidelines. After contacting the patients via the hospital system and obtaining the necessary consents, the Mini Mental State test, Beck Depression test, Beck Anxiety test, and PTSD test were administered to the patients to assess cognitive and psychiatric dysfunction. A detailed history and physical examination were performed to assess physical dysfunction. Patients were asked if they had any limitations in their physical functions after being admitted to the intensive care unit. To assess this, we asked if there was a limitation in their effort capacity, fatigue, and activities that he could do previously, both inside and outside the home. The same researcher conducted all of these tests, and the physical examination and data collection. The test results were scored using the test result scales, and the data were recorded.

Statistical Analysis

For statistical analysis, IBM SPSS 22 (Armonk, NY: IBM Corp.) was used. Categorical variables are presented as numbers and percentages, while continuous variable descriptive statistics are presented as mean ± standard deviation or median (minimum-maximum) value. For categorical variable comparisons in the groups with and without COVID, the chi-square test was used. Depending on the distribution type, continuous variables were analyzed using the Student's t-test or the Mann-Whitney U test. In all statistical tests, cases with $p<0.05$ were considered significant.

Results

When the patients were examined, it was discovered that the average age was 61.1±18.1 (minimum: 20, maximum: 96). While the average age of COVID patients was 67.9±13.6 (minimum: 28, maximum: 96), the average age of non-COVID patients was 54.4±19.7 (minimum: 20, maximum: 94). The mean age of the groups differed statistically ($p<0.001$).

When the length of stay in the ICU was examined, the median length of stay in COVID patients was 6.5 days (2-22); the median length of stay in non-COVID patients was 4 days (2-15). The length of stay in the ICU was longer in COVID patients ($p=0.001$).

It was discovered that 37 of 100 patients did not suffer from depression. Mild depression was observed in 21 people, moderate depression in 39 people, and severe depression in three people. Anxiety was absent in 35 patients, mild in 19, moderate in 40, and severe in 6. In 59 patients, PTSD was found. In 50 patients, cognitive functions were normal. Mild cognitive dysfunction was in 32 patients, moderate cognitive dysfunction in 14 patients, and severe cognitive dysfunction in 4 patients. In 65 of 100 patients, post-ICU syndrome was present.

Depression was not observed in 26% of COVID patients. Mild depression was found in 24% of the participants, moderate depression in 44%, and severe depression in 6%. Depression was not observed in 48% of non-COVID patients, whereas 18% had mild depression and 34% had moderate depression. Non-COVID patients did not have severe depression. Depression was found to be more severe in COVID patients than in non-COVID patients ($p=0.019$) (Table 1, Figure 1).

Anxiety was absent in 22% of COVID patients. Anxiety was mild in 16%, moderate in 50%, and severe in 12% of the participants. While 48% of non-COVID patients do not have anxiety, 22% have mild anxiety, and 30% have moderate anxiety, these patients do not have severe anxiety. When the anxiety levels in the groups were compared, it was discovered

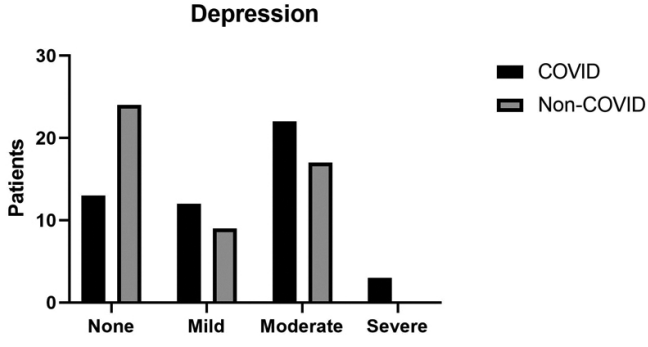

Figure 1. Depression levels in the COVID and non-COVID groups
COVID: Coronavirus disease

Table 1. Depression distribution of the COVID and non-COVID groups

	Depression (n)				
	None	Mild	Moderate	Severe	Total
COVID	13	12	22	3	50
Non-COVID	24	9	17	0	50
Total	37	21	39	3	100

COVID: Coronavirus disease

that patients with COVID had a higher proportion of moderate and severe anxiety than those without COVID (p=0.003) (Table 2, Figure 2).

While the rate of PTSD was found to be 70% in those with COVID, it was 48% in those without COVID. COVID patients had a higher rate of PTSD (p=0.025) (Table 3, Figure 3).

Normal cognitive function was present in 44% of COVID patients, whereas mild cognitive dysfunction was present in 34%, moderate cognitive dysfunction in 14%, and severe cognitive dysfunction in 8% of patients. Patients with normal cognitive function comprised 56% of non-COVID patients, whereas those with mild and severe cognitive impairment comprised 30% and 14%, respectively. In these patients, no serious cognitive dysfunction was observed. Although COVID patients were more likely than non-COVID patients to experience severe cognitive dysfunction, the difference was not statistically significant (p=0.184) (Table 4, Figure 4).

Physical dysfunction was not found in 67 patients; however, it was found in 33. Physical dysfunction was found in 44% of COVID patients but only in 22% of non-COVID patients. The COVID group was shown to have statistically considerably a more physical dysfunction than the non-COVID group (p=0.019).

In those with COVID, the rate of PICS formation was 78%, compared with 52% in people without COVID. Patients with COVID showed a higher percentage of PICS development (p=0.006). The mean age was 44.8±15.2 in patients who did not develop PICS, compared to 69.9±12.8 in people who did. In patients who had PICS, the mean age was greater (p<0.001). Patients with PICS were reported to have a median length of stay in the ICU of 6 days (2-22), compared with 3 days for patients without PICS (2-15). Patients who acquired PICS were observed to have longer stays in the ICU (p=0.008) (Table 5, Figure 5).

Discussion

In this study, patients with COVID had a PICS formation rate of 78%, compared with 52% in the non-COVID patient group. While patients who acquired PICS were found to have a higher mean age, they were also found to have longer stays in the ICU. It was discovered that patients diagnosed with COVID had greater rates of depression, anxiety, PTSD,

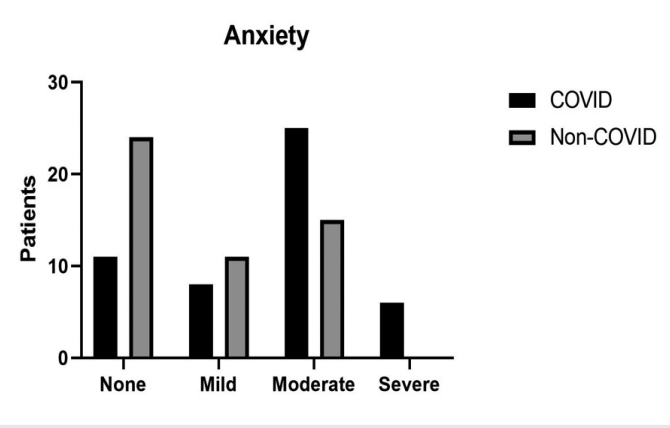

Figure 2. Anxiety levels in the COVID and non-COVID groups
COVID: Coronavirus disease

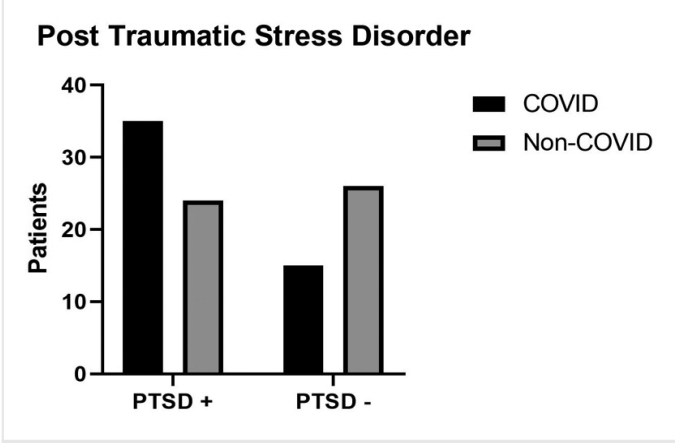

Figure 3. Post-Traumatic Stress Disorder levels in the COVID and non-COVID groups
COVID: Coronavirus disease

Table 2. Anxiety distribution of the COVID and non-COVID groups

	Anxiety (n)				
	None	Mild	Moderate	Severe	Total
COVID	11	8	25	6	50
Non-COVID	24	11	15	0	50
Total	35	19	40	6	100

COVID: Coronavirus disease

Table 3. Post-Traumatic Stress Disorder distribution of the COVID and non-COVID groups

	Post-Traumatic Stress Disorder (n)		
	Positive	Negative	Total
COVID	35	15	50
Non-COVID	24	26	50
Total	59	41	100

COVID: Coronavirus disease

Table 4. Cognitive dysfunction distribution of the COVID and non-COVID groups

	Cognitive dysfunction (n)				
	None	Mild	Moderate	Severe	Total
COVID	22	17	7	4	50
Non-COVID	28	15	7	0	50
Total	50	32	14	4	100

COVID: Coronavirus disease

Table 5. Post-intensive care syndrome distribution of the COVID and non-COVID groups

	Post-intensive care syndrome (n)		
	Positive	Negative	Total
COVID	11	39	50
Non-COVID	24	26	50
Total	35	65	100

COVID: Coronavirus disease

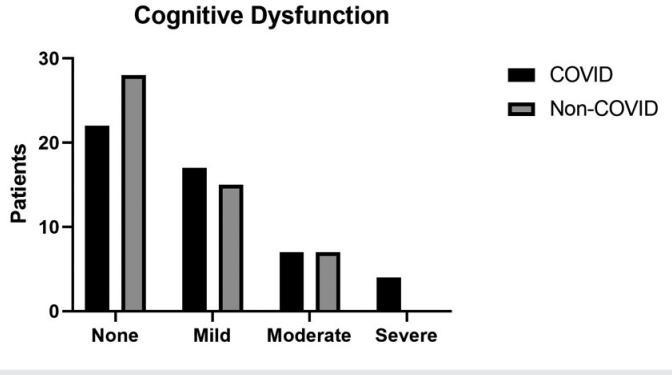

Figure 4. Cognitive dysfunction levels in the COVID and non-COVID groups
COVID: Coronavirus disease

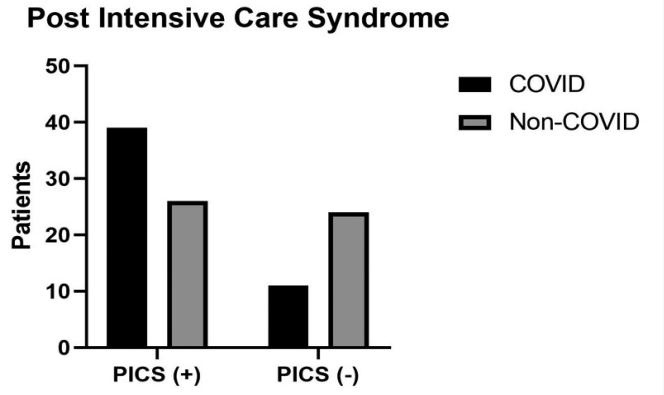

Figure 5. Post-intensive care syndrome levels in the COVID and non-COVID groups
COVID: Coronavirus disease

and cognitive dysfunction. Similar to PICS, individuals with a diagnosis of COVID had a higher mean age and longer stays in the intensive care unit.

According to our analysis of the literature, investigations on PICS are typically published as review articles. In addition, it is notable that the few studies that have looked into the connection between COVID and PICS have all focused on COVID patients who have been intubated and are mechanically ventilated (6,7). The non-invasive ventilated patient population in the intensive care unit is the subject of our study, which is the first of its kind.

Patients with cognitive dysfunction have issues such as trouble concentrating, difficulties focusing, forgetfulness, a loss of problem-solving skills, an inability to articulate oneself properly, and irregularity in performing obligations. This circumstance produces significant issues and disturbances in the patient's entire life, particularly in their post-discharge professional lives (8). According to previous studies, cognitive dysfunction increases the risk of delirium in the intensive care unit. In a different study, patients who were being released from the intensive care unit had delirium between 30% and 80% of the time. In addition to delirium, other issues that could have been discovered before admission to intensive care include hypoglycemia, illiteracy, and low IQ (9). Those with COVID were more likely to have cognitive dysfunction and severe cognitive dysfunction than those without COVID.

We discovered that individuals with COVID had higher rates of depression, but patients without COVID never experienced severe depression. Similarly, patients with a diagnosis of COVID had higher rates of PTSD diagnosis. The general consensus is that a young age, traumatic experience in the intensive care unit, exposure to sedative hypnotics, and intensive care-related psychiatric disorders are also associated with anxiety, depression, and PTSD (4,10-13). Anxiety and loneliness are followed by PTSD, according to a multicenter British study (14). Similar to this, having terrible memories while in the intensive care unit, being sedated for a long time, taking an opiate, having nightmares, and feeling like you can't breathe all increase the risk of developing PTSD (15-17).

In patients diagnosed with COVID, psychiatric symptoms are more prevalent in the older age group, according to our analysis of the study's data. We believe that COVID is to blame for this outcome. When the literature is searched, it is discovered that mechanical ventilator support

is connected to psychological disorders, the majority of which are brought on by depression and anxiety (11). According to a nationwide database registry of more than 24,000 patients on mechanical ventilation, 1% of patients had recently been diagnosed with a psychiatric condition (most commonly anxiety and depression), and 19% were taking psychoactive medications.

In-depth analysis of PICS revealed that risk factors for the condition include neuromuscular disorders, cognitive decline, psychiatric disorders, comorbid ailments, functional regression, mechanical ventilation, severe delirium, sepsis, and ARDS. Due to socioeconomic variables such as poor care and follow-up and the onset of dementia in these individuals, PICS is known to be more prevalent, particularly in older people (18). Parallel to these results, we also found that COVID and PICS are more prevalent in older people.

On the other hand, immobility and social isolation time increase with the length of hospital stay. According to the results of our investigation, PICS incidence increases with patient duration of stay.

Muscle weakness, weight loss, insomnia, anorexia, respiratory problems, and being unable to get up or walk far in the hallway are all signs of physical dysfunction. Another sign is dysphagia (19). Physical dysfunction can make it difficult for patients to go about their daily lives and may even require regular pharmacological therapy. In this study, we analyzed patients who received non-invasive mechanical ventilator support and found that the COVID patient group had a higher prevalence of physical impairment.

Study Limitations

There are some limitations to our study. In our single-center study, the number of patients was limited by the number of admissions. A larger study by performing power analysis can provide more accurate results.

Conclusion

We believe that patients who receive noninvasive mechanical ventilation assistance, those who are intubated and monitored while sedated, and those who receive mechanical ventilator support all fall into the category of patients who are at risk for developing PICS. We believe that PICS is more common in COVID patients receiving noninvasive mechanical ventilator support when we compare the patient group with a diagnosis of COVID with the patient group without a diagnosis of COVID.

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Ethics Committee Approval: The study was approved by the Erzincan Binali Yıldırım University Ethics Committee (approval number: 08/07, date: 21.06.2021).

Informed Consent: Retrospective study.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions: Surgical and Medical Practices - H.G.T., U.K.; Concept - D.O., H.G.T.; Design - D.O., F.S.; Data Collection or Processing - F.S.; Analysis or Interpretation - T.K.; Literature Search - F.S., T.K.; Writing - D.O., U.K.

Conflict of Interest: No conflict of interest was declared by the authors.

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