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## **Structural and factorial analysis of disorders of psychoemotional status in intensive care patients with COVID-19**

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**Purpose:** to analyze the frequency, structure and characteristics of the clinical course of disorders of the psychoemotional status among resuscitation patients with COVID-19 pneumonia.

**Material and methods.** The article summarized the clinical characteristics of 4,856 intensive care patients with COVID-19 pneumonia who received treatment at the Republican Specialized Multidisciplinary Infectious Diseases Hospital Zangiota No. 2 from July 2020 to March 2021. The study included adult patients (over 18 years old). Males prevailed (57.0%). According to the severity of the underlying disease (COVID-19 pneumonia), an extremely serious condition was noted in 13.8% (670 out of 4856) cases. At the same time, the average degree (46.2%) and severe course (40.0%) of COVID-19 pneumonia were diagnosed with almost equal frequency. The distribution of patients in terms of the percentage of lung injury from COVID-19 infection showed that in 9.5% of cases, up to 20% of lung tissue damage was observed. The majority of patients (52.4%) had between 50% and 70% of lung damage on admission to intensive care units.

**Results.** The overall prevalence of disorders of psychoemotional status was 43.5% (2114 out of 4856), including the depressive syndrome was observed in 21.7% (1055 out of 4856) cases. The overall incidence of anxiety disorders among resuscitated patients with COVID-19 was 27.2% (1324 out of 4856), the overall incidence of PTSD was 21.4% (1042 out of 4856). A significant correlation between the development of psychoemotional disorders and the clinical and demographic characteristics of patients with COVID-19 was noted for such predictors as age over 60 years, female sex, severe and extremely severe course of the disease, and more than 50% of the volume of lung damage.

**Conclusion.** Almost half of patients with COVID-19 have various disorders of the psychoemotional status, as well as their combinations. The severity of symptoms of psychoemotional disorders accompanying COVID-19 pneumonia correlates with an increased risk of severe and extremely severe disease.

**Key words:** pneumonia COVID-19, disorders of psychoemotional status, depression, anxiety, post-traumatic stress conditions, structure, factor analysis

### **Rationale.**

According to the World Health Organization, "in the majority of patients with COVID-19, with clinical manifestations, the disease is mild (40%) or moderate (40%), approximately 15% have pneumonia with the development of atypical acute respiratory distress syndrome, requiring respiratory support, and 5% have an extremely severe course with complications such as sepsis and septic shock, thromboembolism and / or multiple organ failure, including acute kidney and heart damage" [1]. More than 80% of patients with COVID-19 treated in intensive care units have psychiatric and neurological disorders, including sleep disturbances, headache, dizziness, myalgia, anxiety and depression, delirium / encephalopathy, psychomotor agitation, stroke, ischemic injury brain, convulsions, coma and meningoencephalitis [2].

According to preliminary results of retrospective cohort studies, it was revealed that in COVID-19, neurological manifestations of varying severity are often observed even in the absence of symptoms of respiratory failure [3].

In world practice, targeted scientific research, laboratory, morphological and clinical trials are continuing to identify potential pathophysiological aspects of the development of various



complications of the new coronavirus infection COVID-19. Neurotropism and the possibility of SARS-CoV-2 invasion into the central nervous system, including vascular reactions, electrolyte imbalance, proinflammatory and procoagulative effects of coronavirus, as well as the characteristic clinical features of cerebral edema and cerebral blood flow disorders that affect the outcome of the disease, are being studied.

Undoubtedly, one of the primary tasks is to continue international research on the development, evaluation of the safety and effectiveness of therapeutic strategies in the correction of psychoemotional status disorders against the backdrop of COVID-19. However, a better understanding of psycho-emotional issues in patients with COVID-19 can provide important guidance for timely interventions for targeted patient populations in need of care and for managing similar situations in any future infectious disease outbreaks.

The aim of the study was to analyze the frequency, structure, and clinical course of psychoemotional status disorders among intensive care patients with COVID-19 pneumonia.

### **Material and methods.**

The article summarized the clinical characteristics of 4856 intensive care patients with COVID-19 pneumonia treated at the Zangiota Republican Specialized Multidisciplinary Infectious Disease Hospital No. 2 from July 2020 to March 2021. The study included adult patients (over 18 years of age). Males predominated (57.0%). Most of the patients corresponded to the age group over 50 years (53%). According to the severity of the underlying disease ( COVID -19 pneumonia ), an extremely serious condition was noted in 13.8% (670 out of 4856) cases. At the same time, the average degree ( 46.2%) and severe course ( 40.0%) of COVID -19 pneumonia were diagnosed with almost equal frequency.

The distribution of patients according to the percentage of pulmonary damage by COVID -19 infection showed that in 9.5% of cases there was up to 20% damage to the lung tissue. The majority of patients (52.4%) had 50% to 70% lung damage on admission to intensive care units.

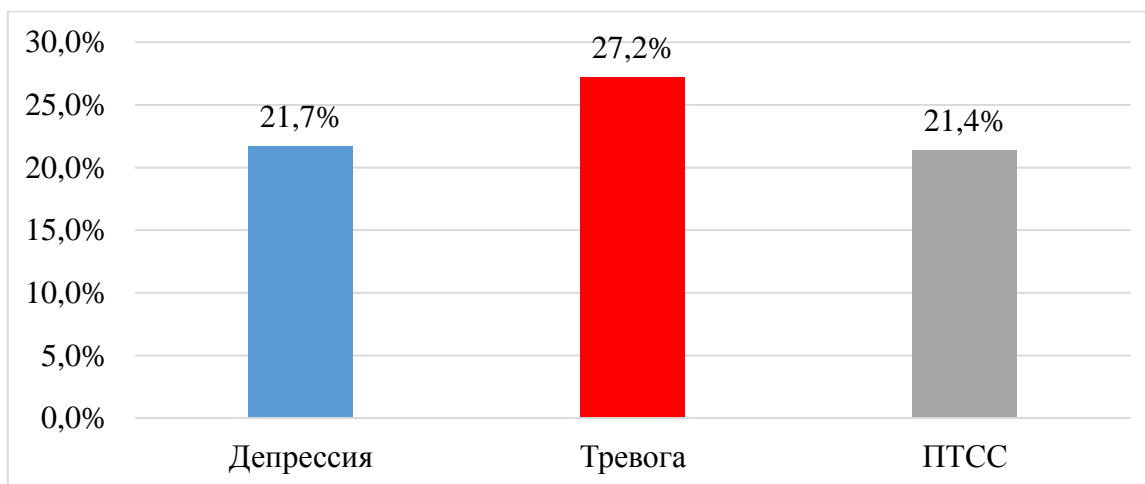
In the course of the study, a structural and factorial analysis of psycho-emotional disorders (depression, anxiety, post-traumatic stress disorder (PTSS) and their combinations) was noted among these patients.

Depressive syndrome was put into a clinical diagnosis in conditions accompanied by tearfulness, a sense of hopelessness, mild excitability or psychomotor retardation, and recurrent thoughts of death. Clinically , anxiety disorders were manifested by fear of illness, fussiness, constant nervousness, trembling, and muscle tension. Patients complained of foreboding, difficulty concentrating, headaches, and inability to relax. Patients with PTSS associated their condition with experiencing the negative impact of the COVID -19 pandemic on their health, the death of a loved one or loved one from COVID -19, noted insomnia and a high level of anxiety, experienced a feeling of slight excitability, became irritable, agitated with a feeling of physical discomfort.

With the help of Microsoft Office Excel 2010 spreadsheets, the initial information was systematized and the results obtained were recoded. Comparison of the average values of nominal indicators was carried out by the distribution of normalized populations and the calculation of Student's t-test. The resulting indicators were evaluated by comparison with the critical value. Statistical significance of differences was recorded in the case of  $p < 0.05$ . An assessment of the significance of the difference between the actual number of outcomes or a qualitative characteristic of the studied cohort and the theoretically due number that could be obtained in the study groups was made by comparing the nominal values using the  $\chi^2$  criterion . The analysis of four-field tables was carried out by calculating the  $\chi^2$  criterion with the Yetz correction , which makes it possible to reduce the frequency of the probability of erroneous results.

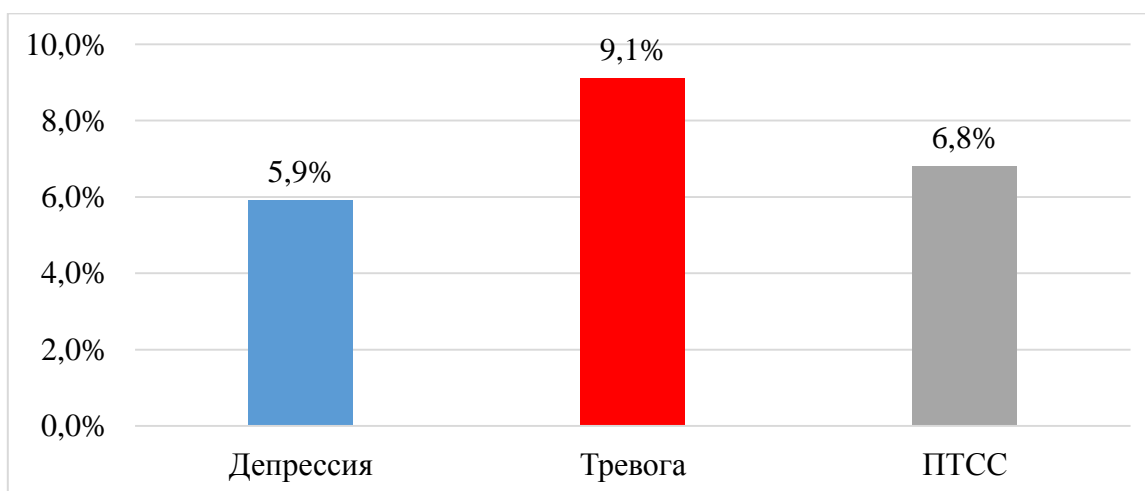
### **Results.**

The overall prevalence of various psychoemotional status disorders was 43.5% (2114 out of 4856), including depressive syndrome was observed in 21.7% (1055 out of 4856) cases. The overall incidence of anxiety disorders among COVID -19 intensive care patients was 27.2% (1324 out of 4856), the overall incidence of PTSS was 21.4% (1042 out of 4856) (Fig. 1).



**Fig. 1. The overall prevalence of various types of psycho-emotional disorders among intensive care patients with COVID -19 pneumonia**

In the course of the study, we noted some difficulties in identifying the frequency of occurrence of various variants of psychoemotional disorders in their isolated form. Thus, according to our data, a depressive syndrome in its pure form could be observed in 5.9% (288 out of 4856) of patients in intensive care units, anxiety disorders were registered with a frequency of 9.1% (440 out of 4856), and PTSD - 6.8% (332 out of 4856) (Fig. 2). At the same time, cases of subsequent transition to various associations of these disorders of the psycho-emotional status of patients were excluded.

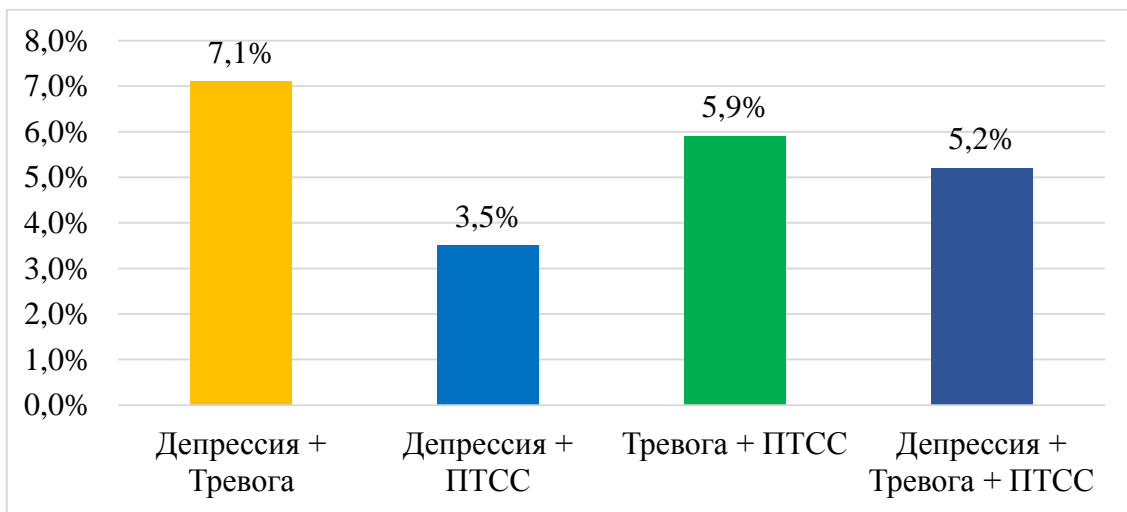


**Fig. 2. The overall incidence of various psychoemotional disorders in isolated form among intensive care patients with COVID -19 pneumonia**

The overall frequency of occurrence of various combinations of psychoemotional status disorders in intensive care patients with COVID-19 pneumonia is shown in Fig. 3. So, depressive-anxiety syndrome was registered with a frequency of 7.1% (344 out of 4856) and was found in patients with initial depression or anxiety disorder with the progression of the mental state within 1-2 days of being in the intensive care unit. Depressive state in combination with PTSS was observed in 3.5% (170 of 4856) patients.

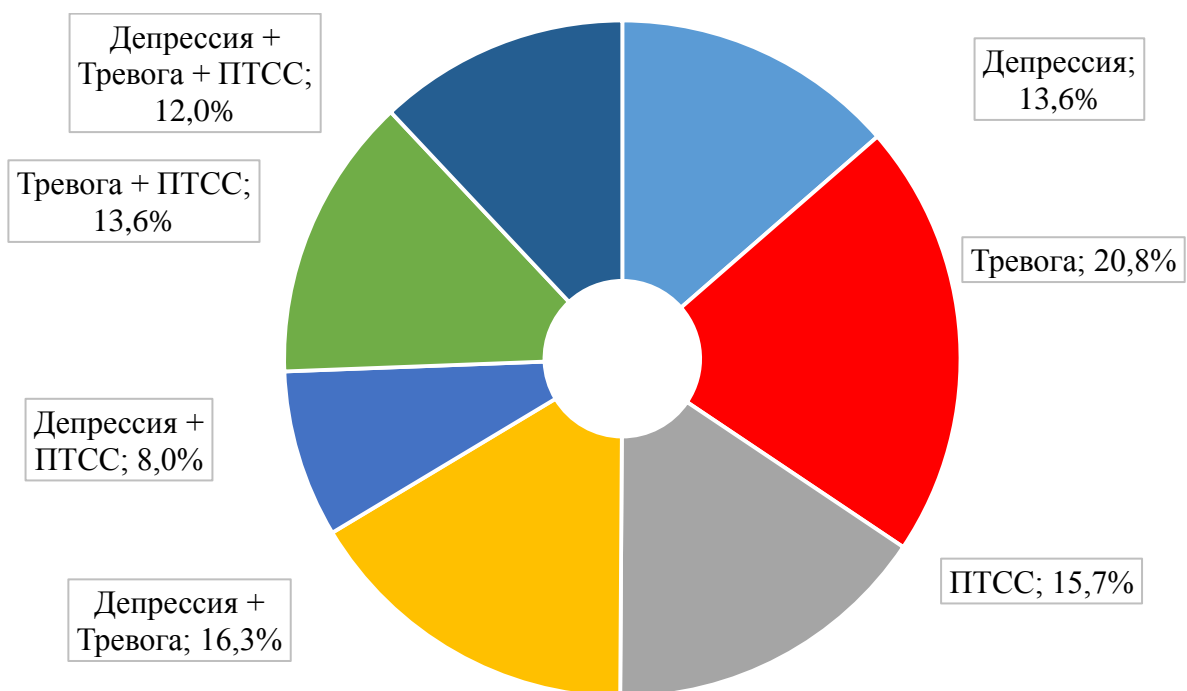
Anxiety disorders and PTSS were diagnosed in 5.9% (287 out of 4856) of cases with persistent nervousness, fear of death and experiences of deaths of relatives or a neighbor in the ward.

The combination of all three types of psycho-emotional disorders was noted in 5.2% (253 out of 4856) of cases of transition of clinical signs of depression into anxiety and PTSS or in the reverse order (Fig. 3).



**Fig. 3. The overall frequency of occurrence of combinations of various types of psycho-emotional disorders among intensive care patients with COVID -19 pneumonia**

In the cohort of patients with COVID -19 pneumonia complicated by psychoemotional status disorders, depressive syndrome was noted in 13.6% (288 out of 2114) of cases, anxiety disorders were diagnosed in the majority - 20.8% (440 out of 2114), PTSS - 15,7% (332 out of 2114) (Figure 3.4). Structural analysis showed that a combination of depression and anxiety was observed in 16.3% (344 out of 2114) of patients with psychoemotional disorders. Depression with PTSS was noted in 8.0% (170 out of 2114) of cases. Anxiety syndrome with PTSS was registered in 13.6% (287 out of 2114) of cases. A combination of all three types of psychoemotional status disorders was found in 12.0% (253 out of 2114) of patients (Fig. 4).



**Fig. 4. The structure of psycho-emotional status disorders in intensive care patients with COVID -19 pneumonia**

Analysis of the four-field tables showed that differences between the cohort of intensive care patients with and without psychoemotional disorders were statistically significant in terms of the development of severe ( $\chi^2 = 11.180$ ,  $p < 0.001$ ) and extremely severe ( $\chi^2 = 13.147$ ,  $p < 0.001$ ) cases of COVID pneumonia -19, as well as in relation to the proportion of patients with a lung injury volume of 50-70% ( $\chi^2 = 14.316$ ,  $p < 0.001$ ), as well as with more than 70% ( $\chi^2 = 10.759$ ,  $p = 0.002$ ) (Table 1).

Statistical analysis showed that in the cohort of patients with psycho-emotional disorders, age over 60 years was noted with a higher frequency ( $\chi^2 = 65.231$ ,  $p < 0.001$ ) than in the group of patients without any disorders of the psycho-emotional status, as well as female patients ( $\chi^2 = 36.418$ ,  $p < 0.001$ ).

Thus, a significant correlation between the development of psychoemotional disorders and the clinical and demographic characteristics of patients with COVID -19 was noted for such predictors as age over 60 years, female gender, severe and extremely severe course of the disease, as well as more than 50% volume of lung damage. .

**Table 1. Determining the relationship between psychoemotional disorders and the clinical course of COVID -19 pneumonia**

Factor	Total	without psycho-emotional disorders	with psycho-emotional disorders	$\chi^2$	R
	%	%	%		
Age > 60 years	32.4%	27.6%	38.7%	65.231	<0.001
Female	36.8%	33.1%	41.6%	36.418	<0.001
Extremely severe course of COVID -19 pneumonia	20.1%	18.3%	22.5%	13.147	<0.001
Severe COVID-19 pneumonia	30.0%	28.0%	32.4%	11.180	<0.001
Volume of lung involvement > 70%	29.1%	27.2%	31.6%	10.759	0.002
The volume of lung damage 50-70%	34.1%	31.8%	37.0%	14.316	<0.001

When analyzing the clinical course of COVID -19 pneumonia among intensive care patients with psychoemotional disorders, it was found that an extremely serious condition was diagnosed in 22.5% (476 out of 2114) cases, which were completely distributed among the combined variants of psychoemotional disorders. Thus, the association of depression, anxiety and PTSS was observed in 10.7% of patients with extremely severe course of COVID -19 pneumonia, making up a significant part of this cohort. (Table 2).

The average severity of COVID -19 pneumonia, noted in the majority (45.1%; 953 out of 2114) of cases of intensive care patients with psychoemotional disorders, was characterized by the development of anxiety in most cases (20.8%), depression (13.6%), PTSD (6.4%) and anxiety-depressive syndrome (4.3%) (Table 2).

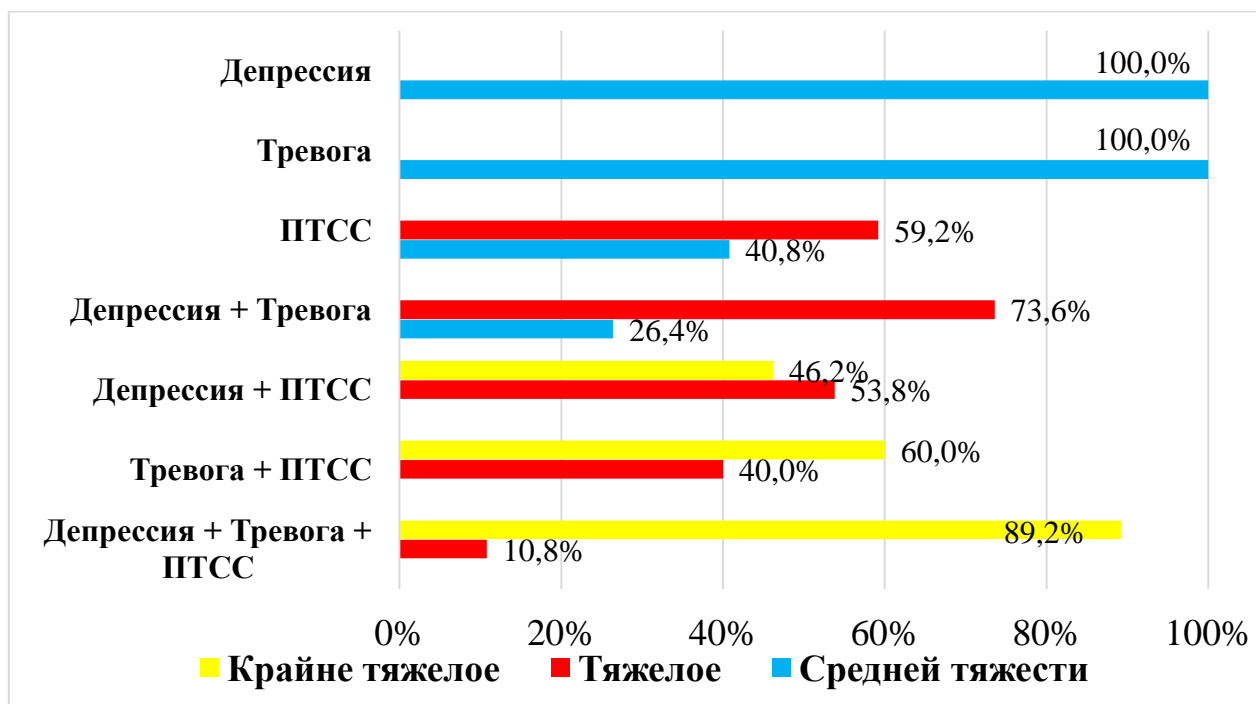
In severe pneumonia COVID -19, diagnosed in 32.4% (685 out of 2114) of patients with concomitant psycho-emotional disorders, anxiety-depressive syndrome was noted in most cases (12%), followed by PTSS (9.3%), combinations anxiety and PTSS (5.4%), depression and PTSS (4.3%), and only 1.3% have a combination of all three options.

**Table 2. Distribution of intensive care patients with COVID -19 pneumonia and psycho-emotional disorders according to the severity of the underlying pathology**

Type of psycho-emotional disorder	Severity of COVID-19 pneumonia
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	Medium	heavy	Extremely heavy
Depression	13.6%	-	-
Anxiety	20.8%	-	-
PTSS	6.4%	9.3%	-
Depression + Anxiety	4.3%	12%	-
Depression + PTSD	-	4.3%	3.7%
Anxiety + PTSS	-	5.4%	8.1%
Depression + Anxiety + PTSD	-	1.3%	10.7%
<b>Total</b>	45.1%	32.4%	22.5%

From fig. 5 it can be seen that in all cases of purely depressive and anxiety syndromes were associated with pneumonia COVID -19 of moderate severity. Isolated PTSS to a greater extent (59.2%) was observed in severe cases of COVID -19 pneumonia , in other cases (40.8%), a clinic of moderate COVID -19 severity was noted . The majority of patients (73.6%) with anxiety-depressive syndrome had severe COVID -19 pneumonia , as well as patients with a combination of depression and PTSD (53.8%). On the contrary, in patients with combined anxiety disorder and PTSS, as well as in the presence of all three variants of psychoemotional disorders, an extremely severe clinic of COVID -19 pneumonia prevailed - in 60% and 89.2%, respectively, in other cases, a severe degree was noted (Fig. 5).



**Fig. 5. Influence of the severity of COVID -19 pneumonia on the features of the clinical course of psychoemotional disorders**

We also studied the relationship between the degree of lung damage upon admission of patients to the hospital with the severity of psychoemotional disorders (Table 3). The distribution of patients according to the percentage of pulmonary damage caused by COVID -19 infection showed that the majority (37%; 782 out of 2114) had 50-70% damage to the lung tissue, in which all variants of psychoemotional disorders developed. In cases of more than 70% of lung lesions (31.6%; 668 out of 2114), exclusively combined variants were observed, with the majority being

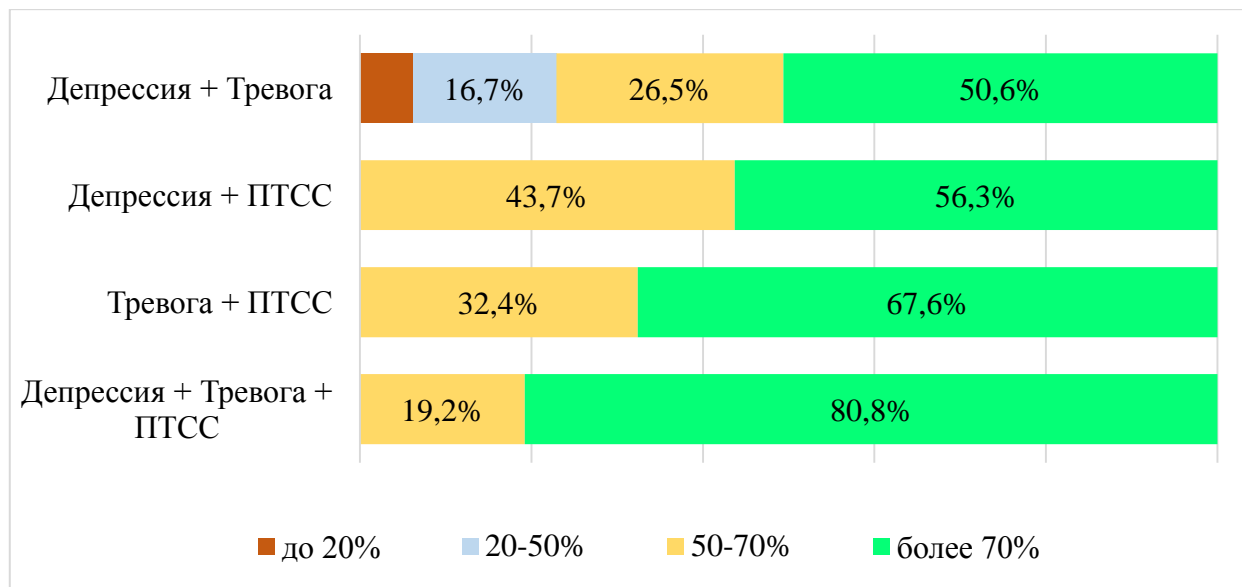


patients with anxiety and PTSD (9.2%) or a combination of all three types (9.7%) of psychoemotional disorders .

In 10.5% (223 out of 2114) cases, up to 20% damage to the lung tissue was observed, and in 20.8% (439 out of 2114) cases, 20-50% of the volume of lung damage was diagnosed, which mainly corresponded to isolated types of disorders of the psychoemotional status (Table .3).

**Table 3. Distribution of COVID -19 resuscitation patients with psychoemotional disorders by volume of lung injury**

Type of psycho-emotional disorder	Volume of lung injury			
	Up to 20%	20-50%	50-70%	Over 70%
Depression	3.0%	4.5%	6.1%	-
Anxiety	3.5%	7.0%	10.2%	-
PTSS	3.0%	6.4%	6.2%	-
Depression + Anxiety	1.0%	2.7%	4.3%	8.2%
Depression + PTSD	-	-	3.5%	4.5%
Anxiety + PTSS	-	-	4.4%	9.2%
Depression + Anxiety + PTSD	-	-	2.3%	9.7%
<b>Total</b>	10.5%	20.8%	37%	31.6%



**Fig. 6. The volume of lung damage in COVID -19 pneumonia and combined variants of psycho-emotional disorders**

From fig. Figure 6 clearly shows that in the overwhelming majority of cases, the combination of all three variants of psychoemotional disorders (80.8%), the combination of anxiety and PTSD (67.6%), MSCT of the chest revealed more than 70% of lung damage, in the rest. A similar picture was observed in a cohort of patients whose condition was complicated by combinations of depression and PTSD (more than 70% of the lesions were noted in 56.3% of cases) or depression and anxiety (in 50.6% of cases).

### Discussion.

Intensive care of patients with COVID-19 pneumonia is a complex clinical task and is often associated with a number of problems, one of which is neurocognitive and psychoemotional disorders associated with both the unique pathophysiology of COVID-19 coronavirus infection and

the development of the so-called "intensive care unit syndrome" . SARS-CoV-2 can also infect the brain, which can directly cause and have adverse effects on brain function and mental health [4].

One previous Chinese study from the beginning of the pandemic, which reported a high prevalence of moderate to severe depressive symptoms, found that anxiety symptoms accounted for 28.8% [5]. In another Chinese study, the prevalence of anxiety and depressive symptoms was 44.6% and 50.4%, respectively [6].

According to the study by EM Liotta et al. (2020) psychoemotional disorders accompanying COVID-19 pneumonia correlated with a fourfold increase in the risk of severe disease [7].

According to a study by Bo et al. (2020) 96.2% of clinically stable patients with COVID-19 reported clinically significant symptoms of PTSS [8].

In a cross-sectional study conducted in Wuhan, China, 2 months after the onset of the COVID-19 pandemic, the prevalence of anxiety, depression, PTSS was 84.69%, 18.57%, and 13.36%, respectively, indicating more severe levels of anxiety and depression. depressive symptoms among COVID-19 patients admitted to hospitals compared with the general population. The authors attribute this to many factors: different views on wearing masks, misperceptions in society, lack of personal protective equipment, uncertainty about the development of the pandemic, and fears of a difficult recovery from the disease [9].

A series of observations by J. Helms et al. (2020) showed that "65% of patients with COVID-19 in intensive care units showed signs of confusion (or delirium), and 69% experienced psychomotor agitation, while the development of delirium correlated with an increased risk of death" [10 ].

According to the results of our study, the frequency of psychoemotional disorders among intensive care patients with COVID-19 pneumonia was 43.5% (anxiety disorders were experienced by 20.8% of patients, depressive syndrome - 13.6%, PTSS - 15.7%. In most cases, a combination of depression and anxiety was noted (16.3%).

To date, there is limited information on risk factors and mechanisms for the development of mental health problems among patients with COVID-19 [11]. At the same time, the known risk factors for neurocognitive impairment in intensive care patients are the deepening of sedation, an increase in the time of respiratory support and stay in intensive care units. Most authors suggest that the neurological effects of SARS-CoV-2 infection are indirectly caused by factors such as low blood oxygen levels, coagulopathy, exposure to sedative and analgesic drugs, isolation, and immobility [10, 12, 13, 14].

Our results showed that the risk factors for the development of psycho-emotional status disorders in patients with COVID -19 were age over 60 , female sex , severe and extremely severe course of the disease, as well as more than 50% lung damage .

### **Conclusion.**

The study clarified the main risk factors for the development of psychoemotional and neurocognitive disorders in patients with COVID-19 pneumonia, depending on the characteristics of the clinical course of the disease. Correlations and clinical predictors of the progression of psychoemotional status disorders in patients with COVID-19 pneumonia were also identified.

The frequency of psychoemotional disorders among intensive care patients with COVID-19 pneumonia was 43.5%. At the same time, an analysis of the structure of psycho-emotional disorders against the background of COVID-19 pneumonia showed that most cases were associated with the development of anxiety disorders (20.8%), depressive syndrome was noted in 13.6% of cases, PTSD - 15.7%. Also, among the associations of psychoemotional disorders, in most cases, a combination of depression and anxiety was noted (16.3%), an anxiety syndrome with PTSS was registered in 13.6% of cases, depression with PTSS was noted in 8.0% of cases, and a combination of all three types of disorders psychoemotional status was detected in 12.0% of patients.

statistically significant correlation between the development of psycho-emotional disorders and the clinical and demographic characteristics of patients with COVID -19 was noted for such

predictors as age over 60 years ( $\chi^2 = 65.231$ ,  $p < 0.001$ ), female gender ( $\chi^2 = 36.418$ ,  $p < 0.001$ ), severe and extremely severe course of the disease ( $\chi^2 = 13.147$ ,  $p < 0.001$ ), as well as more than 50% of the volume of lung damage ( $\chi^2 = 14.316$ ,  $p < 0.001$ ).

The severity of symptoms of psychoemotional disorders accompanying COVID-19 pneumonia correlate with an increased risk of severe and extremely severe disease. Thus, an extremely severe degree of COVID -19 pneumonia prevailed in combined anxiety disorder and PTSS (60%), as well as in the presence of all three variants of psychoemotional disorders (89.2%), and in other cases, a severe degree was noted - 40% and 10. 8% respectively. In addition, against the background of COVID -19, an increase in the frequency of cases (from 50.6% to 80.8%) of the progression of the clinic of psychoemotional disorders with the development of their associations in various variants was noted with more than 70% damage to the lung tissue.

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