CHANGES OF CORTISOL LEVEL IN PATIENTS WITH COVID-19 AND COGNITIVE DISORDERS

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Abstract

The article is presents results of the changes pf cortisol level in patients with COVID-19 and cognitive disorders. It was established increase the main marker of stress – cortisol relative to the physiological norm in all age groups of patients who suffered from COVID-19 and were hospitalized. In the age group 40-50 years, the cortisol level increased on the first day in men on 1.4 times ($p<0.05$) and in women on 1.2 times ($p<0.05$) compared to the physiological norm. Therefore, cortisol can be considered a diagnostically significant trigger for the development of cognitive disorders, which will subsequently lead to drastic changes in the central nervous system.

Keywords: pathogenesis; cognitive dysfunction; COVID-19; cortisol; marker.

Introduction. The beginning of the XXI century for scientists and doctors, it has become a time to rethink the role of coronaviruses in the development of human diseases and change approaches to understanding their epidemic potential [1]. The coronavirus disease is a challenge for the health care system of many countries of the world due to its significant spread, the involvement of many people in the epidemic process, the severity of the course in certain groups of patients, as well as the presence of residual manifestations for a long time [3]. In the

acute course of COVID-19, physicians' attention is focused on identifying and treating acute complications related to COVID-19, whereas after the acute phase, some patients require evaluation and treatment for target system complications. The pandemic of acute respiratory syndrome caused by SARS-CoV-2 requires changes in the approach to the treatment and prevention of cognitive dysfunction, since the presence of comorbidity worsens the course and prognosis of the infectious disease [1].

Therefore, the question of optimizing the diagnosis of cognitive disorders in patients with COVID-19 on the first day of the disease remains relevant and socially significant, which can provide an opportunity to effectively treat not only the infectious disease, but also cognitive disorders that arose against its background [9].

It is known that the level of cortisol in women and men differs, because in women the level of cortisol is physiologically higher, which is due to more pronounced adaptation mechanisms to stressful influences, which is characterized by lower frequency of somatic complications as a result of reactions to acute and chronic stress. At the same time, in men there is a certain physiological pattern between the level of cortisol and testosterone: the higher the level of testosterone, the lower the level of cortisol [2, 7, 9].

The aim of our study was the investigation of the cortisol level of patients with COVID-19.

Materials and methods. The study was conducted at the base Odesa Regional Clinical Hospital (in period from 2021 to 2022). To achieve the purpose and objectives of the study was conducted a cohort prospective, randomized, open, clinical study, where 22 patients aged from 40 to 60 years were examined (the average age of women was 44.28±8.91; men – 50.92±7.86) with an established diagnosis and cognitive impairment.

The inclusion group included patients with pneumonia associated with 2019-nCoV acute respiratory disease who had at least 4 of 5 symptoms of COVID-19: elevated body temperature (≥37.5°C), cough, saturation level 93–98 %, increased respiratory rate (20–29 respiratory movements per minute), general weakness (not less than 40 points on the visual-analog scale), which corresponds to the average severity of the coronavirus disease according to the protocol "Providing medical assistance for the treatment of the coronavirus disease (COVID- 19)" [5, 6].

All patients were informed about the nature of the clinical study and provided written consent.

For the purpose of diagnosis were used the standard methods of anamnesis collection and examination of patients comparing complaints, objective examination data, clinical, biochemical, microbiological and instrumental research methods.

Cognitive disorders in patients were detected using neuropsychological tests: the MMSE, the CDT, and the ten-word memory test [4].

The cortisol concentration was determined by the ST AIA-PACK CORT method, which is intended for *in vitro* diagnostics in a test tube only for the quantitative measurement of cortisol in human blood serum [10].

Results and discussions. It was established that on the first day of hospitalization in all groups of patients was observed a probable increase in the level of cortisol compared to reference values was observed (for cortisol, the range of reference values is - 3.7- 19.4 µg/dL) (Fig. 1).

Fig. 1. The level of blood serum cortisol of patients with COVID-19 on the first day of hospitalization

Note. * - p ≤ 0,05 relative to reference values (3,7-19,4 µg/dL)

In the age group of 40-50 years was observed an increase of cortisol level relative to the upper limit of the physiological norm: in men – on 1.4 times (p≤0.05) and was 27.2±2.4 µg/dL, in women – on 1 .2 times (p≤0.05) and was 23.98±2.14 µg/dL. In patients aged 51-60, the

cortisol level also probably differed from the physiological norm. In men its level increased on 1.5 times (p≤0.05) and equaled 28.85±1.7 µg/dL, in women – on 1.3 times (p≤0.05) and was 25,52±1.35 µg/dL.

The obtained results allow us to testify that in the age group of 51-60 years, the cortisol level was slightly higher than in the group of 40-50 years, which indicates a much more severe course of COVID-19. Currently, the impact of COVID-19 on cortisol is not well understood. It is likely that SARS-CoV and SARS-CoV-2 can induce an immunogenic response to adrenocorticotropic hormone, and thus increase morbidity and mortality by inducing cortisol deficiency [3, 7].

On the 5th day of hospitalization in patients who received basic therapy, the following values of the cortisol level were determined: in the age group of 40-50 years in men, the cortisol level increased on 1.5 times (p≤0.05) and amounted to 29, 6±1.8 µg/dL, in women – on 1.4 times (p≤0.05) and was 27.8±1.5 µg/dL. In patients 51-60 years old: in men, the level of this marker increased on 1.6 times (p≤0.05) and amounted to 31.2±1.9 µg/dL, in women – on 1.5 times (p≤0 .05) and was 28.4±1.7 µg/dL (Fig. 2).
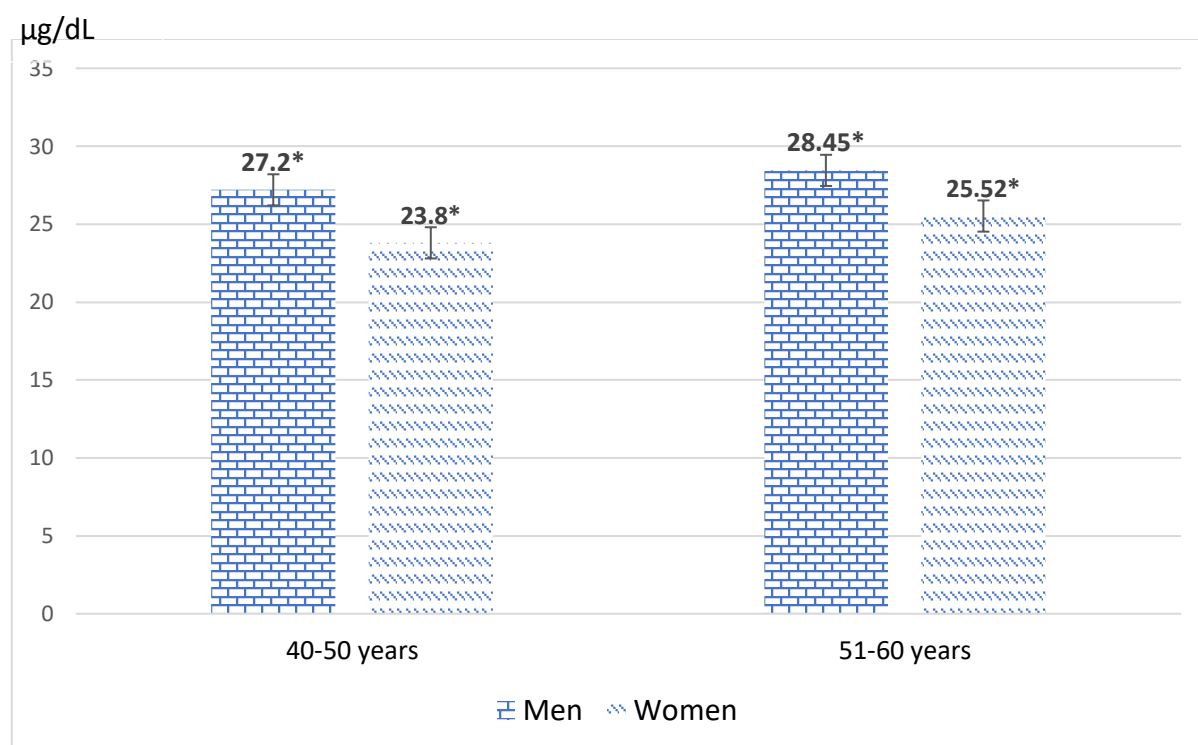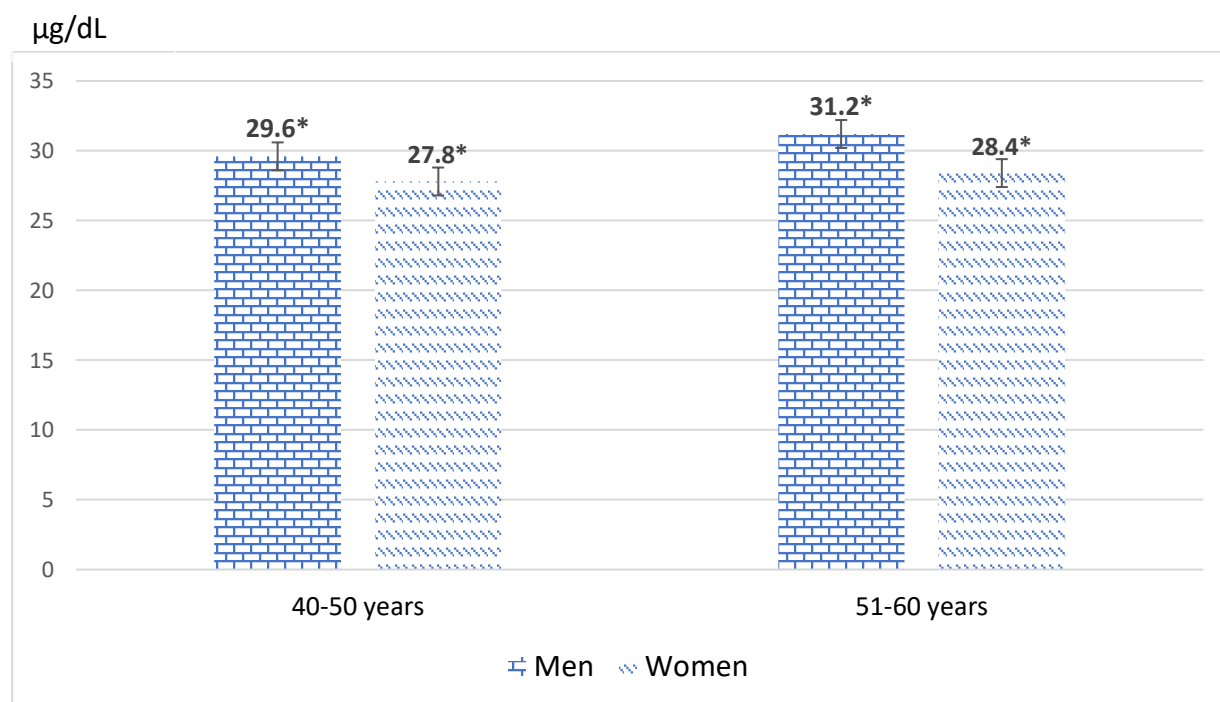
µg/dL

Fig. 2. The level of blood serum cortisol of patients with COVID-19 on the 5th day of hospitalization

Note. * - p ≤ 0,05 relative to reference values (3,7-19,4 µg/dL)

We found out that an increase in the level of cortisol is observed in both age groups of patients and correlates with the form of the COVID-19 infection course. In addition, patients with high serum cortisol levels are likely to have a higher risk of severe COVID-19 and cognitive complications from the disease.

On the 10th day of hospitalization in patients with COVID-19 were noted the following indicators of the cortisol level (Table 1.).

In the age group of patients 41-50 years, the cortisol level in men increased on 1.6 times ($p \leq 0.05$) and amounted to 30.2 ± 2.1 μg/dL, in women – on 1.5 times ($p \leq 0.05$) and was 28.6 ± 2.01 μg/dL.

In patients aged 51-60, the cortisol level in men exceeded the reference values on 1.7 times ($p \leq 0.05$) and amounted to 32.3 ± 1.9 μg/dL, in women – on 1.5 times ($p \leq 0.05$) and was equal to 29.4 ± 1.3 μg/dL.

Therefore, it can be concluded that the level of cortisol against the background of the basic therapy in the treatment of COVID-19 tends to increase.

Table 1

The cortisol level in the blood of patients with COVID-19 on the 10th day of observation (μg/dL)

Patients' group	Sex	Number of patients, n	10th day of hospitalization
41-50 years	m	6	$30,2 \pm 2,1^*$
	w	6	$28,6 \pm 2,01^*$
51-60 years	m	5	$32,3 \pm 1,9^*$
	w	5	$29,4 \pm 1,3^*$

Note. * - $p \leq 0,05$ relative to reference values (3,7-19,4 μg/dL)

The obtained data indicate that COVID-19 acts as a trigger in the development of cognitive disorders due to a sharp increase in the level of cortisol, which will subsequently lead to changes in the CNS.

Conclusion:

1. It was established increase the main marker of stress – cortisol relative to the physiological norm in all age groups of patients who suffered from COVID-19 and were hospitalized.

2. In the age group 40-50 years, the cortisol level increased on the first day in men on 1.4 times ($p<0.05$) and in women on 1.2 times ($p<0.05$) compared to the physiological norm.

Therefore, cortisol can be considered a diagnostically significant trigger for the development of cognitive disorders, which will subsequently lead to drastic changes in the central nervous system.

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