



Evaluation of thyroid function in patients with coronavirus infection

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Abstract

In 2019, the SARS-CoV-2 virus, which caused the novel coronavirus disease (COVID-19) pandemic, presented an unprecedented challenge to health systems and the scientific community worldwide. In addition to the severe form of the acute phase of the coronavirus infection and the pulmonary manifestation of the life-threatening disease, as well as its complications, the long-term changes that occur in the post-coronavirus period also affect other systems: endocrine, cardiovascular, nervous and musculoskeletal systems.

The purpose of the study: Evaluation of thyroid function in patients with SARS-CoV-2 coronavirus infection and development of a special diagnostic algorithm.

On March 11, 2020, the World Health Organization (WHO) announced that the new coronavirus infection Declared a pandemic, COVID-19, the causative agent of which is the RNA-containing b-coronavirus SARS-CoV-2, was first detected in Wuhan, People's Republic of China in 2019, with a global spread. At the time of writing in February 2020, the WHO has confirmed more than 108 million cases of COVID-19 and more than 2 million deaths[1,2].

The coronavirus disease whose infection can range from asymptomatic to severe illness and death [8]. The coronavirus Among several organ systems that can be affected by infection is the thyroid gland. In some patients, coronavirus infection can trigger a hypersensitive immune response and widespread inflammation known as a "cytokinin storm." The most common cause of thyroid problems is that this activation of the immune system due to antigens attacking the thyroid gland can also lead to inflammation and dysfunction of the thyroid gland (autoimmune thyroid disease). The thyroid gland may also have a direct effect on the severity of the infection[2].

Among many medical specialties coronavirus also increases problems in endocrinology. It is known that the treatment of diabetes forms the basis of the work of many clinical endocrinologists. The coronavirus pandemic has affected many aspects of endocrine disease

treatment. It was found that patients with diabetes have a significantly higher risk of developing more severe forms of the disease[3].

Using the results of several scientific works on coronavirus infection and the literature, we have drawn attention to the fact that SARS-CoV-2 infection can cause pathology and complications of endocrine glands, including the adrenal gland, thyroid gland, pituitary gland, gonads, and pancreas. SARS-CoV-2 virus enters human cells mainly through angiotensin-converting enzyme 2 (ACE2) and transmembrane serine protease 2 (TMPRSS2). The protein on the surface of the coronavirus binds to the ACE2 receptor on the surface of human cells. The TMPRSS2 protein facilitates the entry of SARS-CoV-2 into the cell cytoplasm[5].

ACE2 and TMPRSS2 are known to be present in several endocrine glands: the hypothalamus, pituitary gland, thyroid gland, adrenal glands, gonads, and pancreatic islets, with the highest concentration in the testes, followed by the thyroid, and the lowest concentration in the hypothalamus [4].

However, at present, the pathophysiological characteristics and clinical significance of the effect of SARS-CoV-2 on the organs of the endocrine system, as well as the impact of related endocrine dysfunction on the prognosis of patients infected with the coronavirus, have not been fully studied, and are not sufficiently covered in the literature. It is known that ACE2 receptors are present in the tissues of the hypothalamus and pituitary gland, and these glands can be damaged by SARS-CoV-2 directly or as a result of the immune process [5,6].

In addition, coronavirus infection is associated with a systemic immune inflammatory response, including the coagulation and complement systems, and elevated serum levels of several anti-inflammatory cytokines (interleukins (IL-6, IL-1b) alpha tumor necrosis factor, etc.) characterized by. The development of more severe complications of SARS-CoV-2 infection and damage to many organs is caused by the "Cytokine storm".

The development of a cytokine storm associated with a coronavirus infection can cause inflammation of the thyroid gland. [7]. In the acute phase, increased concentrations of pro-inflammatory cytokines, particularly IL-6, cause thyroiditis and associated thyrotoxicosis, the prevalence of which is associated with increased IL-6 [4].

In the study conducted by A. Lania et al., a close relationship was found between thyrotoxicosis and an increase in the level of IL-6 in blood serum: in thyrotoxicosis, a high level of cytokine IL-6 in blood serum was noted. The authors concluded that thyroid dysfunction in patients with SARS-CoV-2 infection is associated with high levels of IL-6 [5].

There is no evidence that patients with autoimmune thyroid disease are more susceptible to viral infection (including SARS-CoV-2) or that they are at risk of developing more severe coronavirus. However, studies by Matau-Salat M. and others show that SARS-CoV-2 can also cause autoimmune thyroid diseases [10].

It is known that the interaction between thyroid cells and viral infection is established under physiological and pathological conditions under the influence of immunomodulatory signaling molecules.[1,2]. Viruses associated with inflammatory-immune responses can be seen as key variables that can influence thyroid function throughout life, thus contributing to the definition of "thyroid biography" at the individual level.[3].

If there is no additional dysfunction of the gland There is no risk of infection with COVID-19. But about cases of thyroid dysfunction, several special questions arise. Many of our patients are on hormone replacement therapy for hypothyroidism also Patients with diffuse toxic goiter are concerned. Their underlying endocrine autoimmune disease or medication may put them at a higher risk of infection or a more severe condition. Of course, there is no evidence that these

people are more likely to be infected than the general population. Because during the pandemic, patients with QB pathology are at a higher risk of infection than the general population it is necessary to follow the rules of isolation or hygiene as much as possible [11,12].

Materials and methods

In the study, a total of 116 patients were evaluated for dynamic Ultrasound and hormonal status. The main group was made up of 86 patients with pathology of the thyroid gland function who were infected with SARS-CoV-2, and the control group was made up of 30 relatively healthy people who did not have coronavirus infection.

During the examination, thyroid hormones (TSH, free T4, Anti-TPO) and thyroid ultrasound were performed. All patients were analyzed according to age and sex. The analysis of the obtained results was carried out using the MS Excel program.

Research results

In order to study the dynamics of the average levels of risk factors, the age at which the examined patients were infected with COVID-19 was analyzed. The average age of the patients included in the study was 47.5 ± 3.12 in the main group, and 42.6 ± 2.72 in the control group (Table 1).

Table 1
Distribution of patients by gender and age

Indicators		Main group (n=86), %	Control group (n=30), %	χ^2	R
Age	Up to 35	40.7	43.3	0.06	0.801
	35 and more	59.3	56.7	0.06	0.801
Sex	A woman	90.7	100.0	3.00	0.083
	Male	9.3	0.0	3.00	0.083
Place of residence	City	29.1	56.7	2.05	0.152
	Village	70.9	43.3	2.05	0.152
Profession	housewife	29.1	16.7	1.78	0.182
	Unemployed	15.1	3.3	2.91	0.088
	Works	30.2	46.7	2.66	0.103
	Pension	11.6	10.0	0.06	0.808
	A student	14.0	23.3	1.43	0.232

Definition: part 2, P – friendship different indicators modern group health criteria percent

Of the 86 patients in the main group, 90.7% were women and 9.3% were men. Among women, hypothyroidism was 4 times more common than men, and the hypothyroid form of autoimmune thyroiditis was 3.5 times more common. The reason why thyroid gland dysfunction is more common among women depends on the hormonal status and metabolic activity of women. Bukhara region is included in the list of the endemic zone, due to iodine deficiency, hormonal changes in women's bodies, i.e. increased exposure to iodine during pre-puberty and puberty, pregnancy, lactation, climacteric periods, it is characteristic that the decrease of thyroid gland function is common among women.

Most of the patients in the main and control groups were rural residents when analyzed by place of residence: 70.9% in the main group, and 43.3% in the control group. The increase in

the pathology of QB activity among the rural population may be related to the fact that the endocrinologist did not undergo an examination on time.

An analysis of patients' complaints was carried out based on a specially prepared questionnaire. Compared to the control group, the main group had higher percentages of indicators. Including general weakness at 94.2%, edema at 68.6%, dysmenorrhea at 40.7%, the feeling of suffocation 31.4%, milk secretion from the breast was 64.0%, constipation, and body weight gain was 72.1%. The fact that these indicators are high in the main group can be considered as clinical signs indicating the presence of CKD pathology, and it was statistically significant compared to the control group. (Table 2).

Table 2
Comparative characteristics of clinical symptoms observed in the basic and comparative group

Clinic	Main group (n=86), %	Control group (n=30), %	χ^2	R
general weakness	94.2	40.0	0.61	0.436
swelling	68.6	3.3	11.48	0.001
tongue enlargement	24.4	0.0	8.94	0.003
tremor	39.5	0.0	3.76	0.053
sweat	54.7	0.0	4.04	0.044
menstrual cycle is normal	15.1	60.0	8.15	0.004
menstrual cycle dysmenorrhea	40.7	16.7	0.15	0.698
menstrual cycle menopause	29.1	1.6	4.42	0.036
memory loss	66.7	11.9	5.48	0.019
hair loss	58.1	1.0	0.60	0.439
the feeling of bending	31.4	0.0	0.28	0.596
milk discharge from the breast	64.0	0.0	19.92	0.000
acne	48.8	00.0	3.20	0.073
nail fracture	26.7	3.3	2.24	0.134
skin is dry	74.4	6.7	3.33	0.068
the skin is moist	4.7	0.0	0.18	0.668
go astray	10.5	0.0	0.37	0.541
cold harden	57.0	0.0	0.12	0.729
pulse is fast	11.6	3.3	0.06	0.805
pulse is slow	69.8	5.7	1.71	0.191
constipation	72.1	23.3	3.55	0.059
diarrhea	4.7	0.0	0.18	0.668
weight gain	72.1	20.0	9.92	0.002
body weight loss	16.3	0.0	2.63	0.105

depression	44.2	13.3	0.01	0.935
sensitivity	46.5	36.7	0.00	0.988
ophthalmopathy	2.3	0.0	0.71	0.399

Note: χ^2 , P – reliability of differences in indicators of the compared groups according to the Pearson criterion

Different severity levels of coronavirus depending on the status of thyroid hormones (TSH, free T4, Anti-TPO), and thyroid function was analyzed. (Table 3).

Table 3
Comparative characteristics of the thyroid hormone indicators and the observed basic and control groups during post-treatment

No	Indicators	Main group (n=86)		Control group (n=30)		P
		M	m	M	M	
1	TSH	5.18	0.58	2.13	0.21	<0.001
2	T4 (free thyroxine)	1.27	0.24	1.32	0.09	>0.5
3	Anti-TPO	109.27	59.84	37,27	5.96	>0.2

Note: P – friendship with different comparative groups, health criteria, and students

When the hormone index was evaluated among the examined patients, it was detected that there were changes among the patients in the main group compared to the control group.

Based on the results of scientific research, it can be concluded that coronavirus infection decreased the function of the thyroid gland and was manifested by the fact that the ratio of TSH and Anti-TPO in the main group of patients was 2.4 and 2.9 times higher than in the control group. A marker of thyroid inflammation is an elevated level of Anti-TPO coronavirus. After infection, the immune system decreases, and the autoimmune inflammatory process in the thyroid gland increases. Therefore, it was found that autoimmune thyroiditis is more common among thyroid diseases than other diseases.

Hormone status was assessed 6 months after the diagnosis of thyroid gland dysfunction in patients with coronavirus infection and after the initiation of individual treatment for each patient based on national standards.

According to the results of the examination, 63% of the patients who started treatment on time had a normalization of the hormonal status, restoration of the function of the thyroid gland (Table 4). In 37% of cases, the existence of conditions such as the presence of genetic thyroid pathologies and autoimmune diseases, decreased activity of the immune system, escalated after passing the coronavirus infection, and the symptoms of the disease persisted until the treatment was carried out.

Table 4
6 months after the transfer of the coronavirus infection
hormonal indicators

No	Indicators	Main group (n=86)		Control group (n=30)		P
		M	m	M	M	
1	TSH	4.18	0.12	2.13	0.21	<0.001
2	T4 (free thyroxine)	0.91	0.38	1.32	0.09	>0.5
3	Anti-TPO	62.18	12.4	37,27	5.96	>0.2

Note: P – friendship with different comparative groups, health criteria, and students

Thus, in patients who have passed the coronavirus infection coronavirus, it was determined that the probability of developing thyroid gland dysfunction is high depending on the level of weight, the increase in the need for oxygen, and the increase in inflammatory mediators in the body, and as a result of the initiation of correct and specific treatment procedures in time, a state of convalescence is observed in 63%.

Conclusion

1. Thus, hypothyroidism was 4 times more common among women than men, and the hypothyroid form of autoimmune thyroiditis was 3.5 times more common. The reason why thyroid gland dysfunction is more common among women depends on the hormonal status and metabolic activity of women.

2. Based on the results of scientific research, coronavirus infection decreased the function of the thyroid gland and was manifested by the fact that the ratio of TSH and Anti-TPO in the main group of patients was 2.4 and 2.9 times higher than in the control group. A marker of thyroid inflammation is an elevated level of Anti-TPO coronavirus. After infection, the immune system decreases, and the autoimmune inflammatory process in the thyroid gland increases. Therefore, autoimmune thyroiditis is more common among thyroid diseases than other diseases.

3. Thus, it was found that the probability of developing thyroid gland dysfunction is high depending on the level of severity of COVID-19, the increase in the need for oxygen, and the increase in inflammatory mediators in the body, and as a result of the initiation of correct and accurate treatment in time, 63% of cases of convalescence are observed.

REFERENCES

1. Leow M.K.-S., Kwek D.S.-K., Ng A.W.-K. et al. Hypocortisolism in survivors of severe acute respiratory syndrome (SARS). Clin. Endocrinol. (Oxf.). 2005; 63(2): 197–202. DOI: 10.1111/j.1365-2265.2005.02325.x
2. Gu J., Gong E., Zhang B., et al. Multiple organ infection and the pathogenesis of SARS. J. Exp. Med. 2005; 202(3): 415–24. DOI: 10.1084/jem.20050828
3. Wei L., Sun S., Zhang J. et al. Endocrine cells of the adenohypophysis in severe acute respiratory syndrome (SARS). Biochem. Cell Biol. 2010; 88(4): 723–30. DOI: 10.1139/O10-022

4. Yao X.H., Li T.Y., He Z.C. et al. A pathological report of three COVID-19 cases by minimal invasive autopsies. *Zhonghua Bing Li Xue Za Zhi*. 2020; 49(5): 411–17. DOI: 10.3760/cma.j.cn112151-20200312-00193
5. Chen M., Zhou W., Xu W. Thyroid function analysis in 50 patients with COVID-19: a retrospective study. *Thyroid*. 2021; 31(1): 8–11. DOI: 10.1089/thy.2020.0363
6. Lania A., Sandri M.T., Cellini M. et al. Thyrotoxicosis in patients with COVID-19: The THYRCOV study. *Eur. J. Endocrinol*. 2020; 183(4): 381–7. DOI: 10.1530/EJE-20-0335
7. Wang W., Su X., Ding Y. et al. Thyroid function abnormalities in COVID-19 patients. *Front. Endocrinol*. 2021; 11: 623792. DOI: 10.3389/fendo.2020.623792
8. Mateu-Salat M., Urgell E., Chico A. SARS-COV-2 as a trigger for autoimmune disease: report of two cases of Graves' disease after COVID-19. *J. Endocrinol. Invest*. 2020; 43(10): 1527–8. DOI: 10.1007/s40618-020-01366-7
9. Sabirov I.S., Murkamilov I.T., Fomin V.V. Functional state of the liver and pancreas during COVID-19: a therapist's view // *The Scientific Heritage*. 2020.No.50-2(50).P.35-41.
10. Sabirov I.S., Murkamilov I.T., Fomin V.V., et al. Prognostic value of D-dimer in the development of thromboembolic complications in new coronavirus infection (COVID-19) // *The Scientific Heritage*. 2021.№.60-2(60).P.38-46.
11. Murkamilov I.T. The relationship between inflammatory markers and the morphofunctional state of erythrocytes and platelets in the new coronavirus disease 2019 (COVID-19) // *Bulletin of the Kyrgyz-Russian Slavic University*. 2021.T.21.No.1.P.43-52.
12. Murkamilov I.T. Cytokine status in new coronavirus disease (COVID-19) // *Bulletin of the Kyrgyz-Russian Slavic University*. 2020.T.20.No. 9.P.55-65.