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LONG-TERM SYMPTOMS OF COVID-19 IN RESIDENTS OF YAKUTSK

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The analysis of the main symptoms of residents of the city of Yakutsk aged 20 to 72 years was conducted, who had a new coronavirus infection COVID-19 3, 6, 9, 12 months ago.

According to the CT protocol from the anamnesis, the severity of the course of the disease has a direct relationship with age, BMI and gender. Almost half of the surveyed indicate a health disorder after suffering from COVID-19. The subjects with hypertension, chronic kidney disease, diabetes mellitus, chronic respiratory tract disease, and ischemic heart disease most often indicated fatigue. With fatigue, the vital capacity of the lungs was lower by 16-17%, a significant decrease in the activity of the enzymes of energy metabolism lactate dehydrogenase and creatine kinase in men was revealed.

Keywords: COVID-19, long-term effects, symptoms.

The long-term health effects of SARS-CoV-2 from COVID-19 remain unclear. According to literary sources, some complain of symptoms for 3 or more weeks, while others suffer for months [4]. In the majority of patients, 100 days after the diagnosis of COVID-19, computed tomography (CT) revealed persistent lung pathologies, and one third of patients had dyspnea [2]. A study in Wuhan, China of 736 survivors of an acute infection with SARS-CoV-2 (COVID-19) showed that after 6 months they were mainly worried about fatigue or muscle weakness, sleep problems, anxiety and depression [1]. Исследователи, анализируя литературу, отметили, что физическое состояние, наблюдаемое у перенесших вирус SARS-CoV, было ниже, чем у здоровых людей, а через 1-2 года наблюдалось неполное восстановление физических функций. Учитывая сходство патологии и клинических проявлений, вызванных SARS-CoV и SARS-CoV-2, пациенты с COVID-19, вероятно, будут иметь аналогичные нарушения физических функций [9]. Weakness has been associated with decreased physical endurance caused by cardiopulmonary dysfunction. In addition, SARS-CoV-2 can cause long-term effects in the central nervous system (CNS), gastrointestinal tract, liver and kidneys [6]. In this regard, scientific research is needed on the impact of the long-term consequences of COVID-19 on human health in order to organize adequate measures for full rehabilitation.

The aim of the study is to assess the long-term consequences of COVID-19 in residents of Yakutsk who had the disease from 3 to 12 months ago.

Material and research methods. The study involved 164 residents of Yakutsk, aged 20 to 72 years old, who had had COVID-19 from 3 to 12 months back. Of these, 96 women (58.18%), men - 68 (41.46%). The average age was 51.07 ± 0.97 (Me-51.5; CI: 49.15-52.98), for men - 50.41 ± 1.51 (Me-51; CI: 47.38-53, 44), women - 51.54 ± 1.26 (Me-53; CI: 49.02-54.05). According to the duration of the transferred COVID-19, all the subjects were divided into 4 groups: up to 3, up to 6, up to 9, up to 12 months ago (Table 1).

In assessing the health status of the patients examined at the Clinic of the Yakutsk Scientific Center for Complex Medical Problems, a questionnaire was used, including questions about the presence of complaints after suffering COVID-19 and diseases of the cardiovascular, nervous, musculoskeletal, and respiratory systems; biomedical research: reception of specialists (cardiologist, neurologist, rheumatologist, therapist), determina-

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Table 1

Patient groups by date after undergoing covid-19, abs. number/%

Sex	Periodic term, months				Total
	Up to 3	Up to 6	Up to 9	Up to 12	
Everything	15/9.2	77/47.2	48/29.4	23/14.1	163/100
Men	6/8.8	32/47.1	18/26.5	12/17.6	68/41.46
Women	9/9.5	45/47.4	30/31.6	11/11.6	95/58.18

Table 2

CT indicators depending on age and gender, abs. number/%

CT	Sex	Age groups, years						Total
		20-29	30-39	40-49	50-59	60-69	70-79	
CT 0	Men	1/10	4/40	2/20	3/30	0/0	0/0	10
	Women	0/0	4/23.5	4/23.5	5/29.4	4/23.4	0/0	17
CT 1	Men	1/5.3	5/26.3	5/26.3	4/21.1	4/21.1	0/0	19
	Women	1/2.4	9/22	12/29.3	11/26.8	7/17.1	1/2.4	41
CT 2	Men	0/0	2/13.3	2/13.3	4/26.7	5/33.3	2/13.3	15
	Women	1/2.4	9/22	12/29.3	11/26.8	7/17.1	1/2.4	27
CT 3	Men	0/0	3/15	5/25	7/35	4/20	1/5.0	20
	Women	0/0	1/16.7	0/0	1/16.7	2/33.3	2/33.3	6
CT 4	Men	0/0	0/0	0/0	1/25	2/50	1/25	4
	Women	1/50	0/0	0/0	0/0	1/50	0/0	2
	Everything	5	28	35	42	41	10	161

tion of hematological, biochemical and immunological parameters, anthropometry, spirometry, ECG. The study was approved by the local committee on biomedical ethics at the Federal State Budgetary Scientific Institution YSC KMP No. 52 dated March 24, 2021 and was conducted subject to the voluntary informed consent of the participants. Determination of biochemical parameters of blood serum was carried out on a biochemical analyzer "LABIO 200" (China) using reagents from the firm " Analyticon" (Germany).

Statistical processing was performed using the SPSS 11.5 for Windows software package. The normal distribution of quantitative indicators was determined by the Kolmogorov-Smirnov test. Descriptive analysis data are presented in the tables as Me (median), Q1 and Q3 (quartiles 25% and 75%).

The significance of differences was assessed using Student's t-test and ANOVA for independent samples with normal distribution and Mann-Whitney test for abnormal distribution. The probability of the validity of the null hypothesis was taken at p <0.05. Correlation analysis was performed using the Pearson and Spearman method, where r is the correlation coefficient, p is the significance of the result.

Results and discussion. Taking into account the data of the protocols of CT of the lungs during illness and discharge reports of patients with COVID-19, all patients were divided according to the degree of lung involvement into 5 groups: CT0 (zero) - no signs of viral pneumonia; KT1 (light) - the presence of a zone of compaction of the type of "frosted glass", the involvement of less than 25% of the volume of the lungs; KT2 (moderate) - the presence of a zone of compaction of the type of "frosted glass", the involvement of 25 to 50% of the lung volume; KT3 (heavy) - zones of compaction of the “frosted glass” type, involving from 50 to 75% of the lung volume. Increase in the volume of the lesion by 50% in 24-48 hours against the background of respiratory disorders during dynamic observation; CT4 (critical) - diffuse compaction of the lung tissue of the "ground glass" type and consolidation in combination with reticular changes. Involvement of more than 75% of the lung volume. Hydrothorax [3].

Correlation analysis showed that the degree of lung involvement had an inverse relationship with gender (r = 0.238; p <0.002): CT0-CT2 is more common in women, and severe and critical lung damage, CT3 and CT4, is more common in men (Table 2).

Table 3

The main complaints of the surveyed after the transferred COVID-19, abs. number/%

Complaints	Total	%	Sex	Term, months			
				Up to 3	Up to 6	Up to 9	Up to 12
Fatigue	68	43	Men	2/8,7	11/47,8	5/21,7	5/21,7
			Women	7/15,6	18/40,0	14/31,1	6/13,3
Deterioration of hair condition	51	33,1	Men	1/8,3	8/66,7	3/25,0	0,0
			Women	4/10,3	22/56,4	11/28,2	2/5,1
Decreased working capacity	50	32,7	Men	2/8,3	13/54,2	5/20,8	4/16,7
			Women	4/15,4	8/30,8	10/38,5	4/15,4
Dyspnea	44	28,2	Men	1/6,3	9/56,3	5/31,3	1/6,3
			Men	2/7,1	12/42,9	10/35,7	4/14,3
Debility	42	26,6	Women	2/13,3	8/53,3	2/13,3	3/20,0
			Men	4/14,8	14/51,9	6/22,2	3/11,1
Sweating	40	25,5	Women	2/12,5	9/56,3	4/25,0	1/6,3
			Men	2/8,3	12/50,0	8/33,3	2/8,3

Table 4

Frequency of complaints based on severity of COVID-19, abs. number/%

Complaints	Пол	The degree of lung damage accordin to the results of CT SCAN				
		CT 0	CT 1	CT 2	CT 3	CT 4
Fatigue	Men	5/21.7	7/30.45	2/8.7	6/26.1	3/13
	Women	9/20	19/42.2	15/33.3	1/2.2	1/2.2
Deterioration of hair condition	Men	2/16.7	4/33.3	3/25	2/16.7	1/8.3
	Women	5/12.8	18/46.2	10/25.6	5/12.8	1/2.6
Decreased working capacity	Men	4/16.7	5/20.8	6/25	6/25	3/12.5
	Women	10/15.2	18/27.3	15/22.7	19/28.8	1/3.8
Dyspnea	Men	1/6.3	5/31.3	4/25	4/25	2/12.5
	Women	4/14.3	13/46.4	8/28.6	2/7.1	1/3.6
Debility	Men	3/20	5/33.3	2/13.3	2/13.3	3/20
	Women	4/14.8	13/48.1	7/25.9	2/7.4	1/3.7
Sweating	Men	1/6.3	5/31.3	5/31.3	3/18.8	2/12.5
	Women	4/16.7	6/25	10/41.7	3/12.5	1/4.2

In addition, the degree of lung damage during COVID-19 disease had a direct relationship with age (r = 0.307; p <0.000) and BMI (r = 0.286; p <0.000).

In the examined subjects, a mild form of lung lesion with CT1 is typical for age groups from 20-29 to 40-49 years, in older groups, moderate lung damage with CT2 is more common. Severe lung damage with CT3 was more common in the 70-79-year-old group. The critical form with CT4 was among the subjects in the age groups from 50-59 to 70-79 years (Fig. 1).

Severe lung injury CT3 was most often in patients with overweight and obesity of the 1st degree, and critical lung injury with CT4 was most often in overweight patients (Fig. 1). An analysis of the questionnaires of the surveyed showed that 40.9% noted a health disorder after suffering a new coronavirus infection. The most common complaints were fatigue, deterioration of hair condition (loss), decreased performance, shortness of breath, weakness and sweating. Table 3 shows the frequency of occurrence of the main complaints depending on the post-covid period. Most of the complaints were among the subjects who were sick with COVID -19 4-6 and 7-9 months ago, and more often in women. Among 24 people

Table 5

Enzyme activity in men and women with complaints of fatigue

Enzyme, U/L	Sex	Fatigue		No fatigue		p
		Me	Q1 – Q3	Me	Q1 – Q3	
LDH	Everything	381.60	348.00-430.50	395.50	355.50-435.50	0.123
	Men	376.00	345.00-425.000	400.00	346.75-442.50	**0.049**
	Women	381.50	346.75-442.50	377.00	338.00-428.25	0.480
CK	Everything	74.50	57.25 – 102.75	88.00	68.00-121.75	**0.050**
	Men	79.00	64.00-128.00	120.00	101.00-185.25	**0.025**
	Women	72.00	55.50-90.00	70.00	54.50-86.25	0.489
ALP	Everything	195.00	165.25-247.75	220.00	169.5-255.5	0.820
	Men	206.00	189.00-249.00	219.00	181.00-255.750	0.682
	Women	182.50	146.75-245.250	230.00	161.25-261.25	0.862
GGT	Everything	30.50	21.00-44.00	32.00	21.75-51.00	0.533
	Men	36.00	21.00-43.00	40.00	27.75-55.75	0.243
	Women	29.00	20.75-44.25	26.00	18.75-52.75	0.786
ALT	Everything	21.50	14.25-32.50	22.00	15.00-39.00	0.959
	Men	25.00	17.00-50.00	40.50	21.00-47.00	0.646
	Women	21.00	13.00-27.00	26.6	13.75-52.75	0.990
AST	Everything	24.00	20.00-26.75	25.00	21.00-31.00	0.282
	Men	23.00	21.00-28.00	25.00	22.75-33.00	0.502
	Women	25.00	20.00-26.25	23.00	19.00-31.00	0.376

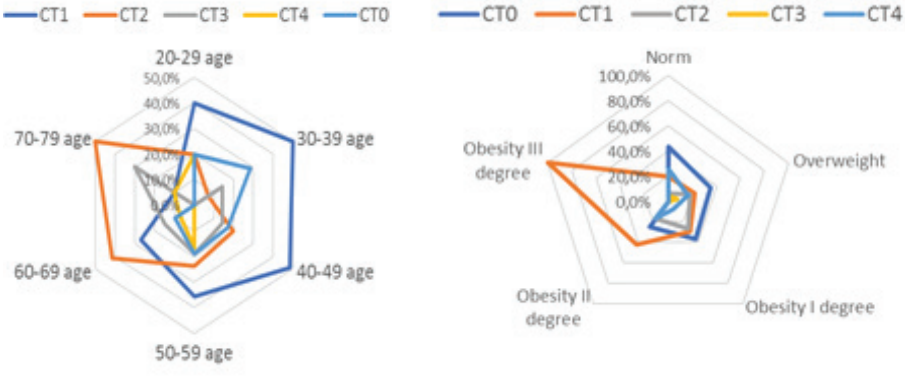

Fig. 1. CT indicators depending on age and BMI

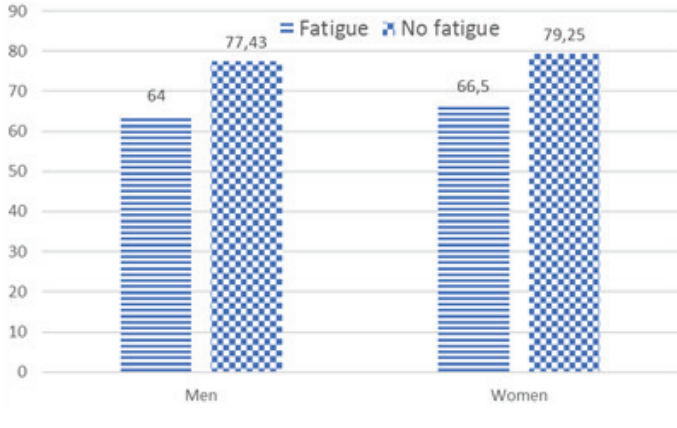

Fig. 2. Lung vital capacity during inhalation (%) in the presence of complaints of fatigue

who underwent a new coronavirus infection for 10-12 months ago, symptoms of fatigue persisted in 11 people (45%), decreased efficiency - in 8 (33%). Other symptoms to a lesser extent also persist for up to a year, except for hair loss in men.

The main complaints, depending on the severity of the course of COVID-19, are shown in Table. 4. Fatigue, deterioration of hair condition, shortness of breath and weakness are most of all complaints in women with CT1 and CT2. Decreased working capacity is observed in all groups and most often in the CT3 group. Among those who have CT0, without lung damage, there is also a sufficient number of complaints of fatigue and decreased performance.

Among the subjects with complaints of fatigue, the vital capacity of the lungs during inspiration in men was lower by 17.35%, in women - by 16.09% (Fig. 2). Among the subjects with complaints of fatigue, 29 people (43.9%) have hypertension, 22 (36.7) have chronic kidney disease, 18 (31.0) have diabetes mellitus, 15 (24.6) have chronic respiratory tract disease, 9 people (15.8%) suffer from ischemic heart disease. In addition, fatigue is associated with the incidence of pathology of the musculoskeletal system ($r = 0.227$; $p < 0.015$).

Analysis of the data on the activity of enzymes of energy metabolism, depending on the presence of complaints of fatigue, showed that the activity of lactate dehydrogenase and creatine kinase was significantly lower in men (Table 5).

The activity of creatine kinase in the subjects decreased after 5-8 months after the transferred infection, further restoration of the enzyme activity was observed (Fig. 3).

Long-term symptoms of COVID-19, such as fatigue, decreased performance, are noted in a few sources [5,8]. Many authors call for further studies of the long-term effects of the novel coronavirus infection caused by SARS-CoV-2, not only among patients recovering from severe acute illness, but also among patients with mild to moderate disease [7].

Conclusion. The severity of the course of COVID-19, according to the CT scan during the disease, has a direct relationship with age, BMI and gender: the new coronavirus infection is more difficult for men of age.

40.9% of the surveyed indicated health problems after the COVID-19 disease. The main symptoms are fatigue, deterioration of hair condition (loss), decreased performance, shortness of breath, weakness and sweating. Fatigue after 12 months after the disease

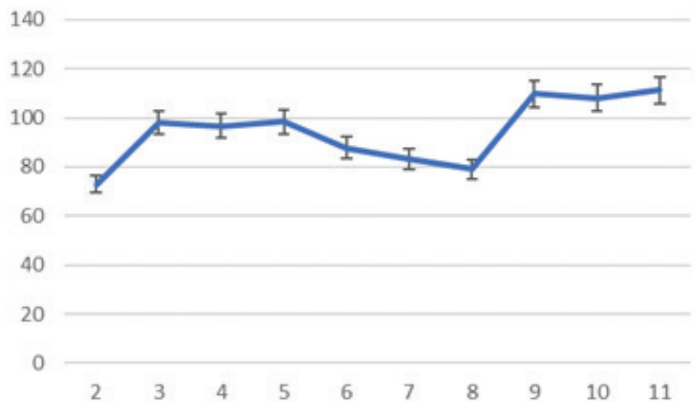

Fig. 3. CK activity depending on the term after the transferred COVID-19, months

COVID-19 remained in 11 people (45%), decreased efficiency - in 8 people (33%). Most often, fatigue is indicated by those surveyed with hypertension, chronic kidney disease, diabetes mellitus, chronic respiratory tract disease, ischemic heart disease. In subjects with complaints of fatigue, the vital capacity of the lungs was lower by 17%. The activity of enzymes of energy metabolism lactate dehydrogenase and creatine kinase is reduced in men with complaints of fatigue. In-depth research is needed to find the causes of persistent long-term symptoms after suffering COVID-19.

Reference

1. 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study / Chaolin Huang et al. Lancet. 2021 Jan 16;397(10270):220-232. doi: 10.1016/S0140-6736(20)32656-8. Epub 2021 Jan 8.

2. Cardiopulmonary recovery after COVID-19: an observational prospective multicentre trial / Sonnweber T, Pizzini A, Schwabl Ch et al. *European Respiratory Journal* 2021 57: 2003481; DOI: 10.1183/13993003.03481-2020.

3. http://education.almazovcentre.ru/wp-content/uploads/2020/05/COVID-19_KT_03052020_versiia_2.pdf

4. https://covid.joinzoe.com/post/covid-long-term?fbclid=IwAR1RxIcmmdL-EFjh_al-

5. https://docs.google.com/document/d/1KmLkOArlJem-PArnBMbSp-S_E3Ooz-D47UzvRG4qM5Yk/edit#heading=h.vgapn9r-j1yg6

6. Li J. Rehabilitation management of patients with COVID-19: lessons learned from the first experience in China. *Eur J Phys Rehabil Med.* 2020 Jun;56(3):335-338. doi: 10.23736/S1973-9087.20.06292-9. Epub 2020 Apr 24.

7. Long-term consequences of COVID-19: research needs / Yelin D, Wirtheim E, Vetter P, Kalil A, Bruchfeld J, Runold M et al. *The Lancet.* Oct 2020. Volume 20. Number 10p1101-1216, e250-e283.

8. Persistent Symptoms in Patients After Acute COVID-19/ Carfì A, Bernabei R, Landi F et al. *JAMA.* 2020 Aug 11;324(6):603-605. doi: 10.1001/jama.2020.12603.

9. Systematic Review of Changes and Recovery in Physical Function and Fitness After Severe Acute Respiratory Syndrome-Related Coronavirus Infection: Implications for COVID-19 Rehabilitation / Rooney S, Webster A, Paul L. *Phys Ther.* 2020 Sep 28;100(10):1717-1729. doi: 10.1093/ptj/pzaa129.

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CORONAVIRUS INFECTION (COVID-19) IN CHILDREN OF THE REPUBLIC OF SAKHA (YAKUTIA)

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The preliminary epidemiological data on coronavirus infection COVID-19 in children in the Republic of Sakha (Yakutia) is presented in the article. Retrospective analysis of 431 cases of coronavirus infection in children who were hospitalized in the Clinical Hospital of Children's Infectious Diseases during the period from March 2020 to December 2020 was conducted. Peaks of the epidemic process were identified in May and November 2020. The COVID-19 virus was identified in 88% of cases, in 54 cases the diagnosis was made based on clinical and epidemiological data. The highest risk group in terms of developing pneumonia are children and teenagers 10-18 years old. Considering of the epidemic process and the peculiarities of the implementation of coronavirus infection, the alertness of pediatricians in the field should be formed.

Keywords: coronavirus infection (COVID-19), pneumonia, children, Yakutia.

Introduction. Information about a new coronavirus infection first appeared in Wuhan City, Hubei Province, People's Republic of China, in December 2019. [5, 6]. A large-scale epidemic spread in China, the World Health Organization outlined the outbreak as an emergency situation and announced the beginning of the pandemic in March 2020 [7]. In Moscow and St. Petersburg the date of registration of the first cases is March 2, 2020 and March 7, 2020, respectively. In Yakutsk (Republic of Sakha (Yakutia)) the first patient with COVID-19 was registered on March 18, 20 [1]. Today the entire world community is focused on fighting with this threat. Different aspects of the epidemic process are being studied to develop effective countermeasures.

Up to the present time, the researches have appeared on the analysis of the prevalence, diagnosis, clinic, and treatment of coronavirus infection in children. For example, a meta-analysis including