

HEART AND VASCULAR REMODELING, THEIR RELATIONSHIP WITH THE CIRCADIAN PROFILE OF BLOOD PRESSURE IN PEOPLE WITH COVID-19

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The relevance of the study is due to the prevalence of cardiovascular complications after COVID-19 worldwide. The aim of the work is to assess the structural and functional changes in extracranial vessels after COVID-19 infection, their relationship with cardiac remodeling and the circadian rhythm of blood pressure. 1 month after COVID-19, 62 men and 38 women aged 63.14 ± 2.24 years were examined in outpatient settings. After COVID-19, 52.0% of patients showed thickening of the intima-media complex (IMC), a significant increase in diameter (by 8.3%) and a decrease in blood flow velocity (by 5.3%) of the right common carotid artery. IMC thickening occurred in 57.3% of cases with hypertrophy and in 36.0% with normal geometry of the left ventricle. With IMC thickening, systolic blood pressure increased significantly by 7.5% and diastolic blood pressure by 12.1%, hypertension time indices systolic blood pressure doubled and diastolic blood pressure by 12.1% during the day; systolic blood pressure by 11.3% at night; average – by 7.1% and maximum – by 9.2% systolic blood pressure, maximum diastolic blood pressure – by 9.2% per day. The presence of significant cardiovascular complications in the form of changes in the thickness of the intima-media complex, disruption of the left ventricular remodeling processes and normal circadian rhythm of blood pressure in patients after suffering a coronavirus disease indicates the need for further research into the etiopathogenesis of such disorders in the case of suffering from COVID-19.

Key words: COVID-19, SARS-CoV-2, intima-media complex, endothelial dysfunction, heart and vascular remodeling, post-Covid period.

Connection of the publication with planned research work.

The results of the study were obtained by the authors during the research work of the Department of Family Medicine of Shupyk National Healthcare University of Ukraine on the topic “Development and Justification of Programs For the Prevention and Treatment of Patients With Comorbid Pathology of Organs and Systems” (state registration number 0122U002416).

Introduction.

Today, COVID-19 is the most massive epidemic of the 21st century, which has affected more than 600 million people and led to 6.5 million deaths worldwide [1]. According to Werlein C. et al., 2023, Gupta A. et al., 2023, even if the acute respiratory syndrome caused by SARS-CoV-2 affects the respiratory system to a greater extent, it manifests itself as a multi-organ pathology, which is characterized by virus-induced vasculopathy, endothelial dysfunction, hypercoagulability and microthrombosis [2, 3].

Many researchers indicate that frequent complications from the cardiovascular system in patients who have had coronavirus disease can be myocarditis, arrhythmias, increased troponin levels, decreased left ventricular ejection fraction and dyskinesia of its walls [4–7].

The definitive pathophysiological mechanisms of cardiac damage in COVID-19 have yet to be elucidated [8], but it has already become clear that the clinical manifestations of cardiac symptoms in patients with COVID-19 and SARS beta-coronavirus, in which myocyte damage and tissue fibrosis occur, are not characteristic of other forms of viral myocarditis [9].

As indicated by Halushka M, Vander Heide R., 2021, currently existing hypotheses for cardiac injury in COVID-19 include direct and indirect myocardial injury by viral infection [10]; Tavazzi G. et al., 2020, reported the presence of SARS-CoV-2 RNA in cardiac tissues [11]; and Albert C. et al., 2020, reported virus-like particles

in cardiac macrophages and cardiomyocytes [12]. Other hypotheses consider the systemic release of pro-inflammatory cytokines, such as TNF- α , IFN- γ , MIP, IL-1, IL-6, and cytokine storm, as the leading causes of cardiac injury with increased vascular wall permeability and myocardial edema [2, 13].

It is believed that some infectious factors, such as HIV, herpes simplex virus, cytomegalovirus and Chlamydia pneumoniae, can lead to thickening of the vascular intima-media complex, similar to age-related and atherosclerotic changes [14]. In the study of Jovanikić O. et al., 2023, mathematical models of aging in COVID-19 were developed: an epidemiological model, where hypertension, smoking and gender influence the thickness of the intima-media complex (IMC); and an epidemiological-inflammatory model, in which, in addition to smoking, hypertension, gender, the importance of biomarkers of endothelial dysfunction was added: IL-6, C-reactive protein and fibrinogen. It has been shown that among all the factors affecting the thickening of the IMT, hypertension has the greatest impact [15]. That is, the issue of cardiovascular remodeling after COVID-19 requires further study.

The aim of the study.

To assess the structural and functional changes in blood vessels and myocardium, their relationship with changes in the diurnal blood pressure profile in people who have had coronavirus infection.

Object and research methods.

100 people with COVID-19 (62 men and 38 women) aged 63.14 ± 2.24 years were examined in outpatient settings. The inclusion criteria for the study were: patients with arterial hypertension aged 45–65 years, who had laboratory-confirmed COVID-19, and who consulted a family doctor for dispensary supervision, who agreed to participate in the study. Exclusion criteria: absence of confirmed COVID-19 disease, age > 65 years, disagreement with participation in the study. The study protocol

was drawn up in accordance with the Declaration of Helsinki and agreed with the Ethics Committee. Examination and treatment of patients were carried out in accordance with the "Protocol for providing medical care for the treatment of coronavirus disease (COVID-19)" [16].

Structural and functional changes in the myocardium and vessels, features of the daily blood pressure profile were assessed using Doppler echocardiography, ultrasound examination of the brachiocephalic arteries, and daily blood pressure monitoring. The examined patients after ultrasound examination of the brachiocephalic arteries were divided into 2 groups: group 1 (CIM<0.9 mm) – 48 people; group 2 (CIM>0.9 mm) – 52 people.

To evaluate the results of the study, primary statistical analysis methods were used [17]. The author used ChatGPT (OpenAI, San Francisco, CA, USA) for language editing of the English text. The author reviewed and verified all AI-generated content to ensure accuracy and integrity.

Research results and their discussion.

As indicated in our previous work, IMC >0.9 mm was determined in 52.0% of the examined, while in 48.0% – IMC was <0.9 mm [18]. The obtained data are comparable with the results of the study Bezerra C. et al., 2022,

which showed that carotid artery lumen irregularity in patients with severe COVID-19 was detected in 55.0%, carotid plaques – in 57.0%, perivascular infiltration – in 8.0%, IMC thickening – in 58.0% of cases [19].

In group 2, compared with the subjects of group 1, the diameter of the right common carotid artery (D RCCA) was significantly larger by 8.3% ($p<0.01$) and the blood flow velocity in the right common carotid artery (Vs RCCA) was smaller by 5.3% ($p<0.05$) (fig. 1). They had increased resistance indices of the right (Ri RCCA) by 4.1% and the left (Ri LCCA) by 2.7% of the common carotid arteries, the right (Ri RICA) by 2.7% and the left (Ri LICA) by 1.4% of the internal carotid arteries, the right (Ri RVA) and the left (Ri LVA) by 1.4% of the vertebral arteries; as well as the diameters of the left common carotid artery (D LCCA) – by 4.2%, the right (D RICA) – by 3.8% and the left (D LICA) – by 5.7% of the internal carotid arteries, the right (D RVA) – by 2.7% and the left (D LVA) – by 2.9% of the vertebral arteries, however, all these changes were not statistically significant. At the same time, in individuals of group 2, a decrease in blood flow velocity was observed in the left common carotid artery (Vs LCCA) by 6.5%, the right (Vs RICA) by 2.7% and the left (Vs LICA) by 2.8% internal carotid arteries, and an increase in the right (Vs RVV) by 3.7% and left (Vs LCA) by 1.7% vertebral arteries (fig. 2).

Intima-media complex thickening (>0.9 mm) was observed among individuals with and without LV hypertrophy – in 57.3 and 36.0% [18].

Data on cardiac remodeling in individuals after Covid-19 depending on the thickness of the intima-media complex are presented below (fig. 3).

In the subjects of group 2, compared with those of group 1, significant changes were observed in the following indicators: an increase in the size of the left atrium (LA) – by 11.9% ($p<0.001$), the left atrial area index (LAAI) – by 20.1% ($p<0.05$), the end-diastolic size of the left ventricle (EDS LV) – by 11.1% ($p<0.001$), the end-systolic size of the left ventricle (ESS LV) – by 13.7% ($p<0.001$), the index of the end-diastolic volume of the left ventricle (IEDV LV) – by 22.3% ($p<0.001$), the end-systolic volume of the left ventricle (ESV LV) – by 32.6% ($p<0.01$), the thickness of the myocardial wall of the left ventricle (ThMV LV) – by 13.0% ($p<0.001$), interventricular septal thickness (IVSTh) – by 13.0% ($p<0.001$), myocardial mass index (MMI) – by 40.9% ($p<0.001$), right atrial area (RAA) – by 15.9% ($p<0.05$), right atrial area index

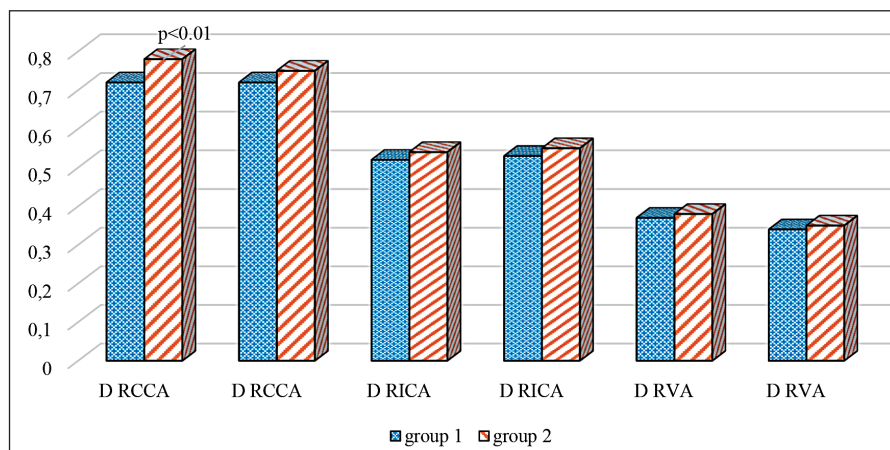


Figure 1 – Features of vessel diameters in patients with Covid-19 depending on the thickness of the intima-media complex.

Notes: diameters D PCCA – right common carotid artery, D LCCA – left common carotid artery, D RICA – right internal carotid artery, D LICA – left internal carotid artery, D RVA – right vertebral artery, D LVA – left vertebral artery.

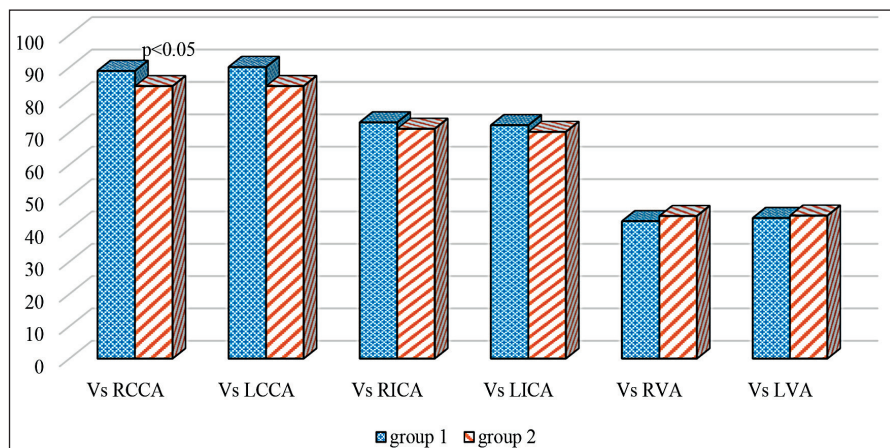


Figure 2 – Features of blood flow velocity in vessels in patients with Covid-19 depending on the thickness of the intima-media complex.

Notes: blood flow velocity Vs RCCA – right common carotid artery, Vs LCCA – left common carotid artery, Vs RICA – right internal carotid artery, Vs LICA – left internal carotid artery, Vs RVA – right vertebral artery, Vs LVA – left vertebral artery.

(RAAI) – by 13.8% ($p<0.05$) and a decrease in ejection fraction (EF) – by 5.3% ($p<0.05$) (fig. 3).

In the same group, aortic root diameter (ARD) increased by 1.6%, left atrial index (LAI) by 2.6%, left atrial area (LAA) by 9.2%, LV end-diastolic size index (EDSI LV) by 4.5%, LV end-diastolic volume (EDV LV) by 2.1%, relative posterior wall thickness (RPWTh) by 18.4%, and LV myocardial mass (MM LV) by 17.1%, but these changes were not statistically significant (fig. 3).

Vascular remodeling in individuals after Covid-19 was associated with the circadian rhythm of BP. As previously reported in our work [18], intima-media complex thickening (>0.9 mm) was observed among individuals with a non-dipper diurnal blood pressure profile – 45.2%, night-peaker – 50.0%, dipper – 39.1%, over-dipper – 44.4%, respectively.

Features of the diurnal blood pressure profile in individuals after Covid-19 depending on the thickness of the intima-media complex are presented in the table.

Compared with the subjects of group 1, in group 2, daytime systolic blood pressure (SBP day) significantly increased by 7.5% ($p<0.001$), diastolic blood pressure (DBP day) by 12.1% ($p<0.05$), time indices of hypertension SBP (SBP IH day) doubled, and DBP (DBP IH day) increased by 68.7% ($p<0.05$); nighttime SBP (SBP night) increased by 11.3% ($p<0.05$); daily average SBP (avSBP per day) – by 7.1% ($p<0.05$), maximum daily SBP (max avSBP per day) – by 9.2% ($p<0.001$) and maximum daily DBP (maxDBP per day) – by 9.2% ($p<0.05$) (table).

The daily variabilities of SBP (VSBP day) increased by 7.7% and DBP (VDBP day) – by 9.6%; nocturnal DBP (DBP night) – by 4.2%, time indices of hypertension SAT (SBP IH night) – by 46.5% and DBP (DBP IH night) – by 56.4%, variability of SAT (VSBP night) – by 7.7% and DBP (VDBP night) – by 8.6%; daily minimum systolic blood pressure (minSBP per day) – by 4.3%, DBP (minDBP per day) – by 4.0%, mean DBP (meanDBP per day) – by 6.3%, minimum mean BP (min meanBP per day) – by 7.6%, mean BP (meanBP per day) – by 4.1%, maximum mean BP (max meanBP per day) – by 5.0%, minimum pulse BP (minPBP per day) – by 18.5%, mean PBP (meanPBP per day) – by 7.0%, maximum PBP (maxPBP per day) – by 10.8%, hypertension time indices systolic blood pressure (SBP IH per day) – by 64.0% and DBP (DBP IH per day) – by 12.7%, however, these changes were not statistically significant.

Considering the results of a number of studies [2], we can say that the pathological process in COVID-19 manifests itself as a primary vascular infiltration by CD11b+/TIE2+ macrophages, which leads to neoangiogenesis and remodeling of the fibrovascular interface of the heart, and not as mononuclear infiltration and damage to myocytes as in viral myocarditis. Studies conducted by Werlein C. et al., 2023, confirm the idea of a peculiar nature of remodeling in COVID-19, which is caused by invaginate angiogenesis in the form of an interaction between

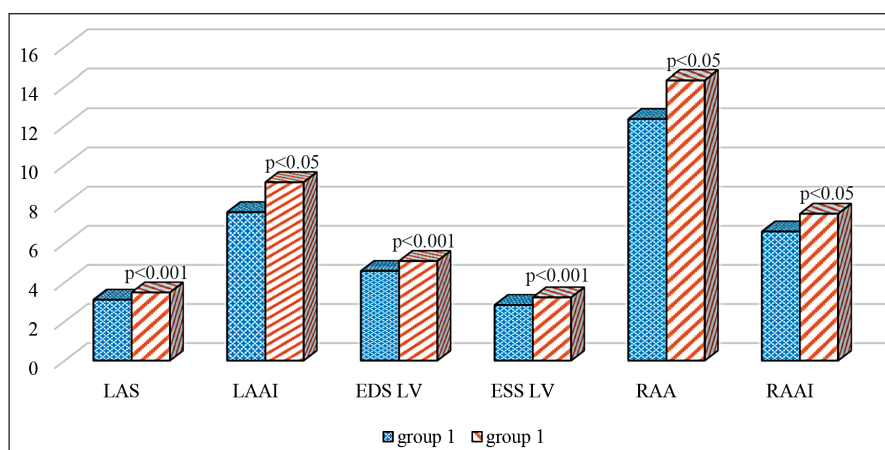


Figure 3 – Features of cardiac remodeling in patients with Covid-19 depending on the thickness of the intima-media complex.

Notes: LAS – left atrial size, LAAI – left atrial area index, EDA LV – LV end-diastolic size, ESD LV – LV end-systolic size, RAA – right atrial area, RAAI – right atrial area index.

incorporated monocytes/macrophages CD11b+/TIE2+ blood and “pathologically affected” endothelial cells in the hearts of patients after coronavirus disease [2],

Schwendinger F. et al., 2024 studies showed that most people who had COVID-19 had left ventricular dysfunction, which was manifested by poor exercise tolerance. The authors emphasized the presence of endothelial dysfunction at the macro- and microvascular

Table – Features of the diurnal blood pressure profile in patients with Covid-19 depending on the thickness of the intima-media complex

Daily blood pressure monitoring indicators	Patients with Covid-19	
	group 1	group 2
SBP day	123.51±3.04	132.76±2.43***
DBP day	78.94±1.76	85.12±1.38*
SBP IH day	13.15±3.76	26.34±3.17*
DBP IH day	16.04±3.15	27.07±4.21*
VSBP day	13.25±0.54	14.28±0.57
VDBP day	10.17±0.43	11.15±0.47
SBP night	114.27±3.42	127.24±2.76*
DBP night	72.45±2.06	75.47±1.34
SBP IH night	17.23±3.98	25.24±4.36
DBP IH night	16.87±3.74	26.24±4.36
VSBP night	11.46±0.76	12.35±0.32
VDBP night	8.32±0.54	9.04±0.43
minSBP per day	91.26±1.98	95.23±2.63
avSBP per day	122.54±1.47	131.23±1.95*
max SBP per day	153.24±2.94	167.35±2.47***
minDBP per day	52.35±1.67	54.47±1.54
Av SBP per day	79.24±0.65	84.23±0.53*
maxDBP per day	103.75±1.74	113.28±2.03*
min meanBP per day	66.2±1.53	71.24±1.65
meanBP per day	93.46±1.93	97.25±1.63
max meanBP per day	118.15±1.64	124.12±1.54
minPBP per day	20.54±1.26	24.35±1.26
meanPBP per day	41.35±1.34	44.25±1.26
maxPBP per day	71.54±3.83	79.28±3.56
minimum Heart Rate	56.24±1.38	57.42±1.44
average Heart Rate	76.23±1.64	73.45±1.84
maximum Heart Rate	116.08±3.21	117.24±3.28
SBP IH per day	14.24±0.56	15.15±0.32
DBP IH per day	21.15±1.64	23.84±2.17

Notes: * – $p<0.05$, *** – $p<0.001$.

levels, which was due to an increase in markers of inflammation, hypercoagulability, organ damage and endothelium within several months after the coronavirus disease [20]. In our previous work, it was shown that left ventricular hypertrophy was detected in people with COVID-19; in 22.0% – eccentric and 18.0% – concentric hypertrophy. Undoubtedly, given the age of the subjects (64.24±3.16 years), we can speak of the presence of certain remodeling changes even before the coronavirus disease. The following diurnal BP profiles were found: dipper in 53.8% of the examined, non-dipper in 30.8%, and night-peaker in 15.4%. In the presence of concentric and eccentric LV hypertrophy, dipper diurnal BP profile was diagnosed in 55.5 and 45.4% of patients. In 36.3 and 50.0% of cases, thickening of the intima-media complex occurred with eccentric hypertrophy and concentric remodeling. In patients with IMC>0.9 mm, dipper diurnal BP profile was diagnosed in 40.0%, non-dipper in 35.0%, night-peaker in 20.0%, and over-dipper in 5.0% of the examined [18].

Netyazhenko V. et al., 2025 showed that in patients with ischemic heart disease who had COVID-19, there was a decrease in cerebral blood flow, a significant deterioration in microcirculation, and an increase in D-dimer and ferritin. The researchers developed an approach to determine an index for assessing the risk of worsening heart failure; established a relationship between ferritin levels and left ventricular systolic function; identified a decrease in cerebral blood flow velocity as an early predictor of heart failure progression in such patients [21].

Bezerra C. S. et al., 2022 emphasized the direct inflammatory effect of SARS-CoV-2, which leads to endothelial dysfunction and is due to the presence of intracellular viral particles and rupture of cell membranes. They also indicated that endothelial damage is associated with kidney disease and an increase in the thickness of the intima-media complex. In severe COVID-19, ultrasound examination of extracranial vessels revealed the presence of luminal surface irregularities in 55% of the examined patients, carotid plaques in 57%, IMC thickening in 58%, and perivascular infiltration in 8%. An 85% risk of death was also found in patients with IMC thickening and acute kidney injury [19].

As indicated in our previous work, IMC >0.9 mm was determined in 52.0% of the examined, while in 48.0% – IMC was <0.9 mm [18]. Now we have established that in individuals with thickening of IMC, the blood flow velocity in the right common carotid artery decreased statistically significantly – by 5.3% and the diameter of the right common carotid artery increased by 8.3%. All other changes were not statistically significant: an increase in resistance indices of the right – by 2.7% and the left – by 1.4% of the internal carotid arteries, the right – by 4.1% and the left – by 2.7% of the common carotid arteries, the right and left – by 1.4% of the vertebral arteries. An increase in the diameters of the right internal carotid arteries by 3.8% and the left internal carotid arteries by 5.7%, the right vertebral arteries by 2.7% and the left vertebral arteries by 2.9%, and the left common carotid artery by 4.2% was observed. At the same time, blood flow velocities decreased by 2.7% and 2.8% in the right internal carotid arteries, by 6.5% in the left common carotid artery, and increased by 3.7% and 1.7% in the right vertebral arteries.

A significant complication of COVID-19 is neurological and cognitive difficulties, which occur in almost 60-70% of those examined and can range from anxiety and mild cognitive impairment to panic attacks and pronounced cognitive changes. Shabani Z, Liu J, Su H., 2023 indicate the presence of “neurocognitive dysfunction”, which can manifest itself within several months after the disease and significantly worsen the quality of life of such individuals. Although to date the nature of mental and cognitive disorders in coronavirus disease has not been sufficiently studied, and their pathophysiological mechanism remains incompletely elucidated [22].

Today, etiopathogenetic studies of the relationship between COVID-19 and cardiovascular diseases (the ability of SARS-CoV-2 to lead to inflammation and endothelial dysfunction) have become urgent due to the significant increase in the number of infarctions and thrombosis in the post-COVID period, and especially in connection with the need and timing of antiplatelet therapy. As Sabit H. et al., 2025 emphasize, etiopathogenetic factors include microRNAs (miRNAs), which modulate the expression of genes involved in vascular homeostasis, inflammation, and platelet formation. Establishing the role of microRNAs (miR-223 and miR-126) in the formation of a response or resistance to antiplatelet therapy for COVID-19 in cardiovascular diseases will provide an opportunity to choose a treatment strategy to reduce the risk of thrombotic events, as well as to understand the mediated mechanisms of cytokine storm and endothelial damage. Therefore, the identification of molecular biomarkers of inflammation is necessary to improve the efficacy of antiplatelet therapy and reduce mortality from cardiovascular complications associated with COVID-19 [23].

Conclusions.

1. In 52.0% of patients after COVID-19, thickening of the intima-media complex was detected, in 48.0% it was normal. In individuals with altered intima-media thickness, the diameter significantly increased by 8.3% and the blood flow velocity decreased by 5.3% in the right common carotid artery; changes in other parameters were not statistically significant.

2. In the presence of left ventricular hypertrophy in individuals with COVID-19, thickening of the intima-media complex occurred in 57.3% of cases, and with normal geometry – only in 36.0%. In patients with increased intima-media thickness, there was a statistically significant increase in the size (by 11.9%) and area index (by 20.1%) of the left atrium, end-diastolic size (by 11.1%) and volume index (by 22.3%) of the left ventricle, end-systolic size (by 13.7%) and volume (by 32.6%) of the left ventricle, thickness of the myocardium of the posterior wall of the left ventricle (by 13.0%) and the interventricular septum (by 13.0%), myocardial mass index (by 40.9%), area (by 15.9%) and index (by 13.8%) of the right atrium, as well as a decrease in ejection fraction (by 5.3%).

3. Thickening (>0.9 mm) and normal (<0.9 mm) intima-media complex were observed among individuals after COVID-19 with a non-dipper diurnal blood pressure profile – 45.2 and 6.4%, night-peaker – 50.0 and 7.1%, dipper – 39.1 and 10.9%, over-dipper – 44.4 and 11.1%, respectively. In individuals with thickening of the intima-media complex, systolic (by 7.5%) and diastolic (by 12.1%) blood pressure, hypertension time indices of systolic (by 2 times) and diastolic (by 12.1%) blood pres-

sure during the day; systolic blood pressure (by 11.3%) at night; average (by 7.1%) and maximum (by 9.2%) systolic blood pressure, maximum diastolic blood pressure (by 9.2%) per day.

4. In the future, determining the nature and degree of remodeling of the heart and extracranial vessels, the features of the circadian rhythm of blood pressure

should be included in the algorithms for diagnosing and treating people with COVID-19.

Prospects for further research.

Further research will be aimed at developing an algorithm for the diagnosis and treatment of coagulopathy in people who have had coronavirus disease.

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РЕМОДЕЛЮВАННЯ СЕРЦЯ ТА СУДИН, ЇХ ВЗАЄМОЗВ'ЯЗОК З ЦИРКАДНИМ ПРОФІЛЕМ АРТЕРІАЛЬНОГО ТИСКУ У ОСІБ З ПЕРЕНЕСЕНИМ COVID-19

Вознюк О. Р.

Резюме. Актуальність дослідження обумовлена поширеністю серцево-судинних ускладнень після перенесеного COVID-19 в усьому світі.

Мета роботи – оцінити структурно-функціональні зміни екстракраніальних судин після перенесеної коронавірусної інфекції, їх взаємозв'язки з ремоделюванням серця та циркадним ритмом артеріального тиску.

Через 1 місяць після перенесеного COVID-19, в амбулаторних умовах було обстежено 62 чоловіки і 38 жінок у віці 63,14±2,24 років. Усім пацієнтам проводили ультразвукове дослідження екстракраніальних судин, доплерокардіографію, добове моніторування артеріального тиску. Методами первинного статистичного аналізу оцінювали дані результатів дослідження.

Після перенесеного COVID-19 у 52,0% хворих виявлено потовщення комплексу інтима-медіа. У цих осіб статистично значуще зростає діаметр (на 8,3%) та зменшувалась швидкість кровоплину (на 5,3%) на правій загальній сонній артерії. Потовщення комплексу інтима-медіа зустрічалось в 57,3% випадках при гіпертрофії та у 36,0% – при нормальній геометрії лівого шлуночка. При потовщенні комплексу інтима-медіа у обстежених

вірогідно збільшувались розмір – на 11,9% та індекс площі – на 20,1% лівого передсердя, кінцево-діастолічний розмір – на 11,1% та індексу об'єму – на 22,3% лівого шлуночка, кінцево-сistolічний розмір – на 13,7% та об'єм – на 32,6% лівого шлуночка, товщини міокарду задньої стінки лівого шлуночка – на 13,0% та міжшлуночкової перетинки – на 13,0%, індекс маси міокарду – на 40,9%, площа – на 15,9% та індекс – на 13,8% правого передсердя, а також зменшувалась фракція викиду – на 5,3%. У обстежених при наявності потовщення комплексу інтима-медіа статистично значуще збільшувались систолічний – на 7,5% та діастолічний – на 12,1% артеріальний тиск, індекси часу гіпертензії систолічного – у 2 рази та діастолічного – на 12,1% артеріального тиску вдень; систолічний артеріальний тиск – на 11,3% вночі; середній – на 7,1% та максимальний – на 9,2% систолічний артеріальний тиск, максимальний діастолічний артеріальний тиск – на 9,2% за добу.

Наявність значних серцево-судинних ускладнень у вигляді змін товщини комплексу інтима-медіа, порушення процесів ремоделювання лівого шлуночка та нормального циркадного ритму артеріального тиску у хворих після перенесеної коронарної хвороби свідчить про необхідність подальших досліджень щодо етіопатогенезу таких порушень при перенесеному COVID-19.

Ключові слова: COVID-19, SARS-CoV-2, комплекс інтима-медіа, ендотеліальна дисфункція, ремоделювання серця і судин, постковідний період.

HEART AND VASCULAR REMODELING, THEIR RELATIONSHIP WITH THE CIRCADIAN PROFILE OF BLOOD PRESSURE IN PEOPLE WITH COVID-19

Vozniuk O. R.

Abstract. The relevance of the study is due to the prevalence of cardiovascular complications after COVID-19 worldwide.

The aim of the work is to assess the structural and functional changes in extracranial vessels after COVID-19 infection, their relationship with cardiac remodeling and the circadian rhythm of blood pressure.

1 month after COVID-19, 62 men and 38 women aged 63.14±2.24 years were examined in outpatient settings. All patients underwent ultrasound examination of extracranial vessels, Doppler echocardiography, and daily blood pressure monitoring. The data from the study results were evaluated using primary statistical analysis methods.

After COVID-19, thickening of the intima-media complex was detected in 52,0% of patients. In these individuals, the diameter increased by 8,3% and the blood flow velocity decreased by 5,3% in the right common carotid artery. Intima-media complex thickening occurred in 57,3% of cases with hypertrophy and in 36,0% with normal left ventricular geometry. With thickening of the intima-media complex in the examined patients, the size of the left atrium significantly increased by 11,9% and the area index by 20,1%, the end-diastolic size by 11,1% and the volume index by 22,3% of the left ventricle, the end-systolic size by 13,7% and the volume by 32,6% of the left ventricle, the thickness of the myocardium of the posterior wall of the left ventricle by 13,0% and the interventricular septum by 13,0%, the myocardial mass index by 40,9%, the area by 15,9% and the index by 13,8% of the right atrium, and the ejection fraction decreased by 5,3%. In the examined subjects with thickening of the intima-media complex, systolic blood pressure increased statistically significantly by 7,5% and diastolic blood pressure by 12,1%, hypertension time indices systolic blood pressure doubled and diastolic blood pressure by 12,1% during the day; systolic blood pressure by 11,3% at night; average systolic blood pressure by 7,1% and maximum systolic blood pressure by 9,2%, maximum diastolic blood pressure by 9,2% per day.

The presence of significant cardiovascular complications in the form of changes in the thickness of the intima-media complex, disruption of the processes of left ventricular remodeling and normal circadian rhythm of blood pressure in patients after suffering a coronavirus disease indicates the need for further research into the etiopathogenesis of such disorders in the aftermath of COVID-19.

Key words: COVID-19, SARS-CoV-2, intima-media complex, endothelial dysfunction, heart and vascular remodeling, post-Covid period.

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A – Work concept and design, B – Data collection and analysis, C – Responsibility for statistical analysis, D – Writing the article, E – Critical review, F – Final approval of the article.

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