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**ПОСТКОВИДНЫЙ СИНДРОМ И СЕРДЕЧНО-СОСУДИСТЫЕ
ЗАБОЛЕВАНИЯ**

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POST COVID AND HEART DISEASE
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Резюме. Длительный синдром COVID оказал значительное влияние на жизни миллионов пациентов по всему миру. Заболевания сердечно-сосудистой системы связаны с худшими исходами после коронавирусной инфекции (COVID-19), хотя данные о долгосрочных результатах и прогностических факторах отсутствуют либо противоречивы. Цель исследования — охарактеризовать исходы и влияние основных заболеваний сердца после перенесенной госпитализации из-за COVID-19.

Ключевые слова: постковидный синдром, коронавирусы, сердечно-сосудистые заболевания, SARS-CoV-2.

Resume. Long COVID syndrome has a profound impact on the lives of millions of people worldwide. The cardiovascular system is an important aspect of a multifaceted disease that can manifest in different ways. Cardiovascular disease is characterized as the worst acute outcome after COVID-19 (coronavirus disease), although data on long-term effect, outcomes, and prognostic factors are lacking. Our objective is to characterize the outcome and impact of the underlying disease after a surge in hospitalizations due to COVID-19.

Keywords: post Covid, COVID-19, cardiovascular disease, SARS-CoV-2.

Relevance. Post Covid is also referred to as LONG COVID this known as post-acute sequelae of SARS-CoV-2 infection (PASC), these persist symptoms for 6 weeks or 2 months, more after acute phase of COVID-19 infection. Heart disease is linked to worse acute outcomes after coronavirus disease 2019 (COVID-19) for example increased risk of cardiovascular disease (CVD) issues, blood clotting abnormalities etc.

The data analyst made a survey by registry HOPE-2 (Health Outcome Predictive Evaluation for COVID 19-2, NCT04778020). On 31 December 2021 with 9299 patients were hospitalized with COVID-19 and 1805 died during the acute phase, finally 7014 patients with heart disease data were included in the present analysis from 56 centers in 8 countries (UK, India, USA, etc.). More risk patients were older age of 58 to 73 years old with cardiac disease present, when compared to female vs male ratio male is affected more 63%. When vaccination was found to be an independent protector factor (HR all cause death: 0.09; 95% CI: 0.04-0.19).

Aim: to show and discuss about the heart disease due to post COVID-19 (LONG COVID-19). This is still an unsolved problem till now.

Material and methods. This review article synthesizes current research on the impact of post COVID-19 on cardiovascular health. Relevant studies were identified

through a comprehensive literature search in databases such as Pubmed, Mayoclinic clevand clinic, Scopus and Web of science. Key findings related to the pathophysiology of insulin resistance and its contribution to cardiovascular diseases were analyzed and synthesized.

Results and their discussion. There stages of Long COVID which is Acute phase: symptoms occur during the initial COVID-19 typical 4weeks. Post-Acute phase, which is predominately from 4 to12 weeks and Chronic phase, which last longer than 12 weeks and continues till months to year. Pathophysiology of Long COVID-19 is harm to the tissue and cells that are related to vascular flow so therefore blood clotting is increased, persistence of fragments of virus or its sub- particles/ protein material in a wide range of tissue, an altered immune system, chronic cardiovascular effect of COVID-19 reported virus is CVD.

Cardiovascular disease as risk factor for Long COVID syndrome.

Cardiac pathologies is increased the risk of Long COVID syndrome. In a study that included 198 601 patients with Long COVID, Ioannou et al. showed that patients with pre-existing congestive heart failure have 34% higher risk of developing Long COVID compared to those who did not have pre-established heart failure. In the same study, it was found that patients with ischemic heart disease and previous myocardial infarction had a significantly higher risk of suffering from the persistent symptomatology of the post-acute COVID-19 condition. Furthermore, a recent meta-analysis of 860 783 patients demonstrated that patients with ischemic heart disease have a 28% higher risk of developing Long COVID syndrome, however, conflicting evidence regarding other pre-existing cardiac conditions and their contribution to the development of Long COVID syndrome. Two studies showed that pre-existing hypertension is not linked with the development of the post-acute COVID-19 sequelae. In a meta-analysis of 10 longitudinal studies (LS) in the United Kingdom, it was shown that neither hypertension nor hypercholesterolaemia were significant predictors of Long COVID. However, these data contradict the results of a cross-sectional study of 442 patients, which showed that the risk of developing—specifically cardiac-related—Long COVID symptoms were two-times higher in those with underlying CV diseases or risk factors, including hypertension, dyslipidaemia, atrial fibrillation, heart failure, and valvular heart disease.

Obesity has been shown by several studies to be an important independent risk factor for the development of Long COVID syndrome. In the Post-hospitalization COVID-19 (PHOSP-COVID) study, which included infection 2320 patients, it was shown that obese patients were 50% less likely to recover fully 12 months after their acute COVID-19 infection. This observation could be explained by the immunological role the adipose tissue has in its ability to become a reservoir for viruses, including the SARS-CoV-2, and the promotion of persistent systemic inflammation and endothelial dysfunction. Pre-existing diabetes has also been shown to be a significant risk factor for Long COVID syndrome, although this has not been confirmed by all studies in the field. In a meta-analysis of 10 longitudinal cohorts, diabetes was not shown to be a significant risk factor for Long COVID, However, a larger meta-analysis of 18 studies and 259 978 patients showed that patients with diabetes are 6% more likely to develop Long COVID syndrome, a risk significant although small.

In conclusion, there is strong evidence demonstrating that pre-existing obesity, heart failure, and ischemic heart disease are significant risk factors for the development of Long COVID syndrome. However, there is conflicting data in literature about other CV diseases such as hypertension, cholesterol, atrial fibrillation, and diabetes mellitus.

Symptoms emerged such as arrhythmia, shortness of breath, fatigue, chest pain, fatigue, insomnia, depression and anxiety, joint pain, reduced exercise and endurance of activity autonomic disturbance associated with COVID-19 is postural orthostatic tachycardia syndrome. The initial picture of COVID-19's harmful effect on heart was observed through clinical report of cardiac injury which always seen in autopsy and cardiac biopsies. Research using inducible pluripotent stem-cell derived cardiomyocyte models, cellcultures and mouse models has been crucial understanding, impact on heart, revealing direct viral damage to cardiomyocyte. The bio marker in CHF is NT- proBNP and troponin it's often elevated in COVID-19 and other respiratory illness. The complexity of virus impact was recognized only during the acute phase.

In 2022 a study by Al-Aly et al., 8 using veterans Affairs Healthcare, it revealed a cardiovascular impact of COVID-19 in 2020-2021, the higher incidence of condition resulted like stroke, arrhythmia, myopericarditis, ischemic heart disease, heart failure and venous thrombosis among hospitalized (unvaccinated need intensive care). The hazard ration of major cardiac event was 1.55% of COVID-19 and high risk of complications.

Cardiovascular disease as complication of Long COVID.

Long COVID has also been development of new onset cardiovascular diseases in subjects without pre-existing co- morbidities. In a study of 153 760 patients, it was shown that patients with Long COVID syndrome have a 1.6 times higher risk of new onset CV disease of any type, including dysrhythmias, non-ischemic and ischemic cardiomyopathies, cerebrovascular and thrombotic disorders. This was evident for a variety of diseases including ischemic heart disease, heart failure, dysrhythmias, inflammatory cardiac diseases, and thromboembolic disease. New onset diabetes mellitus type2 and hypertension have also been commonly noted in patients with Long COVID.

Some antivirals reduce the severity, for example nirmatrelvir, in combination with ritonavir, was found to reduce the prevalence of LONG COVID by 26% by reducing the risk of arrhythmia and coronary heart disease. Oral drugs such as molnupiravir are also used, but they do not cure re-infection. Currently, reliable multicenter studies remain limited, although some interventions such as the single-blind, single-center randomized controlled trial (RCT) of the synbiotic formula (combination of prebiotic and probiotic) SIM01 showed significant improvement in fatigue and dyspnoea. Targeted metabolic modulator dysfunction has shown potential in reducing fatigue.

Some therapies like plasma apheresis, hyperbaricoxygen is observational studies pharmacotherapy involving beta blockers, fludrocortisone and midodrine has been positive effects. Pre-vaccination can prevent the high risk of COVID-19 infection.

Conclusions. Long COVID syndrome points to a highly dynamic area that remains to be explored. The human immune and inflammatory responses are key

mechanisms in the pathophysiology of Long COVID syndrome, with cytokines and proinflammatory molecules potentially triggering cardiac disease. There are several risk factors, such as pre-existing obesity, heart failure, or coronary artery disease, that increase the risk of developing Long COVID. The most common cardiac symptoms include chest pain, palpitations, shortness of breath, and syncope. These may present in isolation or in combination with pathological evidence of myocardial injury. Diagnostic procedures such as echocardiography or CMR imaging may be helpful. Vaccination and certain medications, such as antivirals, have been shown to reduce the risk of Long COVID syndrome. The complexity of post-COVID and cardiac issues continues to pose an ongoing challenge, especially with complications. The full severity of the disease, including its impact on quality of life, remains unclear. With millions of people worldwide continuing to suffer, and potentially increasing due to new variants, the public health and economic implications are significant. The condition is still not understood to be a medical emergency. This is a challenging situation for public health and physicians.

Literature

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