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Reversible Deterioration of Myocardial Strain as a Post-COVID-19 Condition - Case Report

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Abbreviations: GSL: Global Longitudinal Strain.

Abstract

Background: The coronavirus infection ravages the World for a second year now, with millions of people infected many of whom lost their lives. It is well known that SARS-CoV-2 affects predominantly the respiratory system but other organs and systems, including the cardiovascular system, could also be damaged. Analyses indicate that in almost all critically ill patients (98%) and in a large proportion of those who were not in critical condition (78.3%) an alteration of the myocardial function is observed. Echocardiography gives us valuable information about the myocardial damage. In addition, global longitudinal strain might help in detecting subclinical damage. It also plays a role in the risk stratification and in the long-term follow-up of the patients with COVID-19.

Case presentation: Considering these facts, we present a case report of a patient who recovered after a COVID-19 infection, but suffered a reversible deterioration of myocardial strain as a post-COVID-19 condition.

Conclusions: Our clinical case shows that left ventricular myocardial strain analysis is an important method for long-term follow-up of patients who recovered after a COVID-19 infection. Early diagnosis in such patients is of crucial importance for their timely treatment and appropriate management.

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Background

The infection caused by SARS-CoV-2 turned into a pandemic. Up to 03-Apr-2021, 131 million cases have been reported with around 2.84 million deaths. The coronavirus infection affects predominantly the respiratory system but other organs and systems, including the cardiovascular system, could also be damaged [1-3]. In 8 to 28% of cases with COVID-19 acute cardiac damage is observed, which relates to a worse prognosis. In SARS-CoV-2 infection, several cardiovascular manifestations could be seen: Acute myocarditis, cardiomyopathies, arrhythmias, heart failure, cardiogenic shock, but the data regarding the myocardial involvement is limited [1,4]. As a matter of fact, in 80% of cases of patients recovered from COVID-19 myocardial damage is found on magnetic resonance imaging [5]. Based on that it can be assumed that long-term cardiovascular consequences might be observed in patients with no visible myocardial involvement during the acute phase of the infection [5]. Myocardial damage could be suspected from the clinical presentation, elevated levels of high sensitive troponin and left ventricular dysfunction on transthoracic echocardiography. The analysis of the Global Longitudinal Strain (GLS) with speckle tracking echocardiography could give more insight into the subclinical myocardial involvement. In addition, the deterioration in GLS makes possible an earlier detection of myocardial damage before the reduction of the left ventricular ejection fraction [6]. Based on this data we describe a case of a patient recovered from COVID- 19 infection, in whom a reversible subclinical myocardial damage is seen. Long-term consequences caused by this new for us virus are not fully examined, but their early detections is vital for the eventual treatment of these patients. We present the following case in accordance with the CARE reporting checklist.

Case presentation

We present a 43-year-old patient hospitalized for two weeks because of COVID-19 pneumonia in October 2020. He was treated with antibiotics, antipyretics, Remdesivir, infusions, oxygen, prophylactic anticoagulation and reconvalescent plasma. The patient has arterial hypertension from nine years, on regular therapy, and dyslipidemia treated with statin. He has a healthy lifestyle-regular physical activity, non-smoker. After he was discharged from the hospital, he started complaining from sharp pain in the chest, which necessitated a Cardiologist consultation December 2020. During the examination, we found inadequate blood pressure control. A transthoracic echocardiography was performed, with data for borderline left ventricular end diastolic wall thickness, with preserved volumes, dimensions, systolic and diastolic function and GLS - 16.7%, reduced mainly in the basal segments and some mid segments in a nonischemic fashion (Figure 1).

The rest of the ultrasound examination was normal. A control examination was scheduled after 3 months, his antihypertensive treatment was optimized and he was advised to continue the antiplatelet therapy.

After 3 months at the control visit, the patient was asymptomatic, with optimal blood pressure control. The echocardiography revealed left ventricle with preserved geometry, volumes and dimensions, preserved systolic and diastolic functions, GLS - 21.3%, without any deviations in the rest of the parameters. Therefore a complete recovery of the GLS compared to the initial ultrasound examination was observed (Figure 2). He was advised to resume his usual sport activity and to continue his antihypertensive treatment.

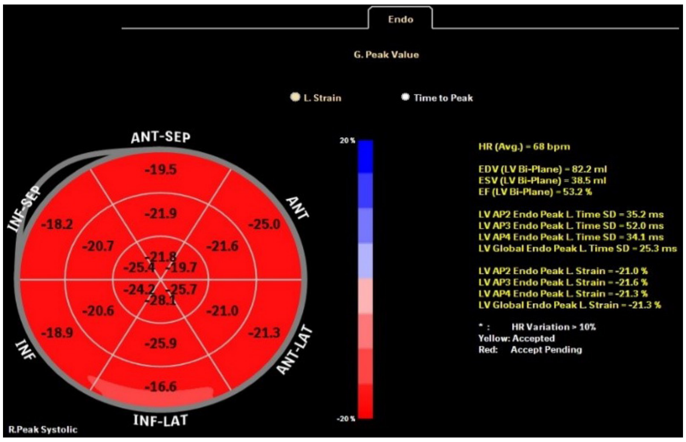

Figure 1: Transthoracic echocardiography of the patient during the first examination after the COVID- 19 pneumonia showing GLS of - 16.7%.

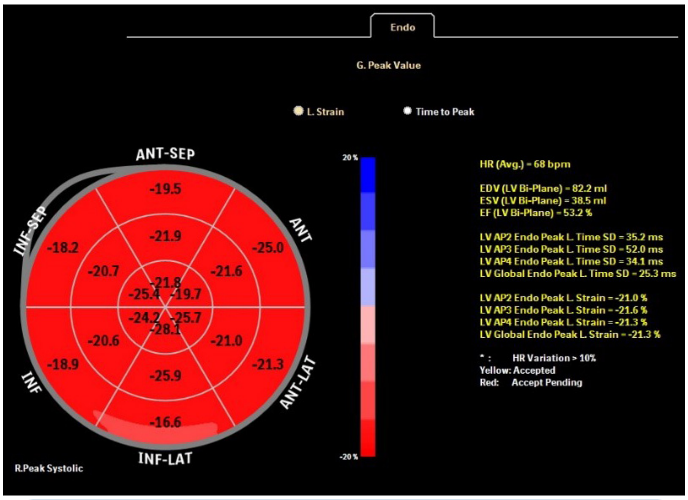

Figure 2: Transthoracic echocardiography of a patient after COVID-19 pneumonia at control visit showing complete recovery of GLS (-21.3%).

Discussion

2D- speckle tracking echocardiography is a quantitative method, which is used to assess global and regional myocardial function. It is essential for detecting subclinical myocardial damage [7].

The analysis of the left ventricular strain with 2D- speckle tracking echocardiography shows us the percentage of deformation between two myocardial regions. The left ventricular strain gives more accurate information about left ventricular dysfunction compared to the ejection fraction [1,8].

Myocardial damage as a result of SARS-CoV-2 infection is due to direct and indirect mechanisms. In the direct ones the virus enters the myocardium causing inflammation and death to cardiomyocytes. On the other hand, the indirect mechanisms of myocardial involvement are connected with the respiratory failure with consequent hypoxemia and the systemic inflammation [9-11]. Microvascular dysfunction, rupture of atherosclerotic plaques, and thrombosis are other mechanisms leading to myocardial damage. The application of GLS as an echocardiographic parameter is essential for patient with COVID-19 infection who are with preserved ejection fraction. It as a reliable prognostic marker for cardiovascular events and mortality [12,13].

Some of the initial analyses of patients hospitalized in COVID-19 departments in whom 2D-speckle tracking echocardiography is performed indicate that in almost all patients in critical condition (98%) and in a large proportion of those who are not in poor general condition (78.3%) deviations in myocardial function are observed [14]. In addition, the strain in these patients proves to be a more sensitive marker for myocardial damage compared to high- sensitive troponin and the natriuretic peptides. The value of GLS also show a connection with the levels of the inflammatory markers and oxygen saturation. GLS corresponds to the amount of lymphocytic infiltrates from the endomyocardial biopsy and to the edema found on magnetic resonance imaging - two highly specialized examination that are not easily accessible in everyday practice [7,14].

On the other hand, one analysis shows that deterioration in myocardial function is demonstrated in 78% of patients around 71 days after the diagnosis COVID-19 pneumonia [15]. Worth mentioning is the fact that in SARS-CoV-2 infection deterioration in the myocardial deformation is observed mainly in basal, the middle part of the inferior or anterolateral segments of the left ventricle which could be partially explained with the hydrostatic edema from patients' posture (usually lying down) [16].

A study among 132 patients with COVID-19 infection finds that after three months of follow-up both left and right ventricular strain improve in the recovery phase. Lee et al. also demonstrate a recovery of the left ventricular function after a 30-day follow-up [17]. Other authors also report a reversal in myocardial dysfunction after an average of 14 days [18]. This fact is confirmed in our clinical case. Therefore, after the acute inflammatory response the deterioration in myocardial function is probably reversible. The present data and our own experience show that longitudinal strain has an important role in the stratification of the risk and the long-term follow-up of patients affected by COVID-19 [19].

Of significant importance to physicians, taking care of patients with post-COVID-19 conditions is the question whether these people could resume their sporting activities. In these cases, the determination of subclinical myocardial damage and its consequent recovery, persistence, or worsening, might help us to give the patient the right guidance. We should not forget that these are often young people, for whom sporting activities are not only a part of everyday life but also a predisposition for a healthy lifestyle and longevity.

Although due to the increased risk of infection, a routine application of echocardiography in the COVID-19 departments is not recommended, in the setting of clinical worsening in a patient, a focused examination with a shortened time of contact could be achieved, with strain analysis performed offline [20].

Conclusions

So far, there is not enough data about the long-term effects on myocardial function in patients who survived COVID-19 infection. The analysis of left ventricular strain might provide prognostic information regarding the cardiovascular events and mortality and is a useful tool for determining subclinical myocardial damage. Our clinical case shows that left ventricular myocardial strain analysis is an important method for long-term follow-up of patients who recovered after a COVID-19 infection. Early diagnosis in such patients is of crucial importance for their timely treatment and appropriate management.

Declarations

Ethical statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient.

Consent for publication: Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and materials: All data generated or analysed during this study are included in this published article and its supplementary information files.

Competing interests: The authors declare that they have no competing interests.

Authors' contributions: SI performed the medical examination, was the author of the idea for the clinical case and edited the clinical case. YHD and HM were the major contributors in writing the manuscript; DN edited the clinical case; VT edited the clinical case; All authors read and approved the final manuscript.

Footnote: We present the following case in accordance with the CARE reporting checklist.

Conflicts of interest: All authors have completed the ICMJE uniform disclosure form. The authors have no conflicts of interest to declare.

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