International Journal of Medical Sciences And Clinical Research
(ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ijmscr

Research Article

CARDIAC ULTRASOUND ALTERATIONS IN INDIVIDUALS WITH PNEUMONIA RELATED TO COVID-19 INFECTION

Submission Date: June 05, 2024, **Accepted Date:** June 10, 2024,
Published Date: June 15, 2024
Crossref doi: https://doi.org/10.37547/ijmscr/Volume04Issue06-07

A.T. Ahmedov
Bukhara State Medical Institute named after Abu Ali ibn Sino, Republic of Uzbekistan, Bukhara, Uzbekistan

ABSTRACT

A wide range of cardiac effects are observed during the acute phase of COVID-19. Interestingly, troponin levels are raised in 8–28% of instances, while systolic myocardial dysfunction symptoms are not always evident. Subclinical myocardial dysfunction is more common and is commonly defined as a decrease in the left ventricle's global longitudinal strain (LV GLS). Up to 80% of individuals exhibit this alteration while they are in the hospital. LV GLS is a crucial component in risk assessment for follow-up care and a strong independent predictor of in-hospital mortality. The first results on the long-term cardiovascular effects of COVID-19 one year after hospitalization are presented in this study. One year after discharge, we found that patients with COVID-19 pneumonia had a negative trend in LV GLS and deformation metrics in the apical and certain middle segments of the LV myocardium, as compared to data collected three months after discharge. The purpose of the study is to look at the prevalence and clinical significance of long-term heart injury following COVID-19. In order to do this, we examined patient data and categorized patients a year following hospital discharge according to their LV GLS values. This method aids in comprehending the clinical ramifications of long-term cardiac injury after COVID-19.

KEYWORDS

To compare clinical and echocardiographic parameters in patients with proven COVID-19 pneumonia, depending on the magnitude of global LV longitudinal strain (LV GLS) one year after discharge.

INTRODUCTION

International Journal of Medical Sciences And Clinical Research
(ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Material and research methods: The recruitment of patients was carried out from September 2021 to February 2022. All examined gave written informed consent to participate. Inclusion criteria: documented diagnosis of COVID-19-associated pneumonia, willingness of the patient to participate in observation. Exclusion criteria: chronic diseases in the acute stage, a history of oncological diseases lasting less than 5 years, tuberculosis and other diseases accompanied by pneumofibrosis, HIV, hemodynamically significant heart defects, chronic hepatitis. Exclusion criteria: unsatisfactory imaging on echocardiography (EchoCG), dilated, restrictive and hypertrophic cardiomyopathy, pregnancy detected during the observation period, oncological diseases, refusal to participate.

58 patients who had COVID-19 pneumonia were examined after a year ± 2 weeks. after discharge, the mean age was 53.0 ± 16.7 years (from 18 to 84 years); 56.8% of them are men. The parameters of global and segmental longitudinal myocardial deformity of the left ventricle were studied in all examined patients with optimal visualization quality in echocardiography (EchoCG). Patients were divided into groups depending on the LV GLS value: group 1 - with normal LV GLS (< -20%) - 26 people, group 2 - with depressed LV GLS (≥ -20%) - 32 people. The groups did not differ in age (p = 0.145), severity of lung injury during hospitalization (p = 0.691), duration of hospitalization (p = 0.626) and frequency of stay in intensive care units (ICU) (p = 0.420).

Hospitalization data are obtained from extracts from case histories. The severity of lung injury was assessed in accordance with current recommendations [4], and the maximum volume of lung injury was analyzed. According to CT data, during hospitalization, 16 (27.9%) patients had mild lesions, 20 (34.5%) had moderate lesions, 17 (29.3%) had severe lesions, and 5 (8.6%) - critical. 9 (15.5%) patients underwent treatment in intensive care units (ICU) (Table 1).

Table 1.

Comparison of clinical data of hospitalization in patients with COVID-19-associated pneumonia

Parameters		Group with normal LV GLS (≤-20%) n=26	Group with LV GLS disorders (≥-20%) n=32	*p*
Duration of hospitalization	days	13.6±3.7	17.2±4.3	0.634
Mild pneumonia	n (%)	5 (19.2)	11 (34.4)	0.308
Moderate pneumonia	n (%)	9 (34.6)	11 (34.4)	0.834

International Journal of Medical Sciences And Clinical Research
(ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Severe	n (%)	8 (30.7)	7 (21.9.3)	0.413
Critical pneumonia	n (%)	8 (30.7)	9 (28.1)	0.873
ICU admission	n (%)	4 (14.7)	5 (15.6)	0.486

One year following their release, every patient got a CT scan of the lungs and an echocardiogram utilizing the state-of-the-art Vivid S70 ultrasonic diagnostic equipment. Using TomTec software, EchoCG data were examined on an IntelliSpace Cardiovascular workstation (Philips, USA). Taking into consideration gender variations and indexation to body surface area, the linear dimensions of the cavities and wall thickness of the heart, chamber volumes, and ventricular systolic function were evaluated in compliance with the guidelines [5].

Using the C. Otto et al. approach, the peak systolic pressure in the pulmonary artery (pSPPA), the pressure in the right atrium, and the peak pressure gradient of tricuspid regurgitation are determined [6, 7]. All of the patients who were examined had their global and segmental longitudinal myocardial abnormality of the left ventricle checked with the best possible visualization quality. AFI (Automatic Functional Imaging) mode was used to evaluate LV longitudinal strain indicators [5, 8]. The lower limit of normal was defined as the global longitudinal strain (LV GLS) value greater than –20% [5]. There were 35 individuals in group 1 with normal LV GLS (< -20%) and 45 individuals in group 2 with impaired LV GLS (≥ -20%). The results of the examination were entered into the electronic database. The groups did not differ in age, severity of lung damage during hospitalization.

Statistical analysis was performed using the SPSS 21 software package (SPSS Inc., Chicago, IL, USA) and STATISTICA 12.0. The normality of the distribution of quantitative indicators was checked by the Kolmogorov-Smirnov criterion. Normally distributed quantitative indicators were represented by the mean and standard deviation (M ± SD), in the case of a non-normal distribution, by the median (Me) and the interquartile range [Q1–Q3]. Dichotomous categorical indicators were described by absolute (n) and relative (in %) frequencies of occurrence. Identification of statistically significant intergroup differences in indicators was carried out for normally distributed quantitative indicators using Student's t-test for independent groups, in the absence of normality - using the Mann-Whitney test. Pearson's $\chi 2$ test was used to identify statistically significant differences between categorical indicators. The critical level of significance was $p = 0.05$.

Results: in contrast to group 1, the majority of patients in group 2 were represented by men, the body surface area (BSA) in this group was larger (Table 2).

International Journal of Medical Sciences And Clinical Research
(ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Table 2.

Comparison of clinical characteristics of patients with COVID-19-associated pneumonia

Parameters		Group with normal LV GLS (≤-20%) n=26	Group with LV GLS disorders (≥-20%) n=32	*p*
Age	years	50.9 ± 12.9	46.1 ± 15.9	0.148
Male	n(%)	10 (28.6)	32 (71.1)	<0.001
Height	cm	166.3 ± 7.8	171.3 ± 17.7	0.003
Weight	kg	75.8 ± 13.1	87.8 ± 18.6	0.002
BMI	kg/m2	27.42 ± 4.65	28.79±5.03	0.873
body surface area	m2	1.8±0.2	2.0±0.2	0.486

Age, body mass index, incidence of obesity, and cardiovascular disease did not differ between the groups. The incidence, composition, and length of arterial hypertension (AH), chronic heart failure (CHF), frequency of cardiac rhythm abnormalities, and glycemic profile did not differ significantly either. Group 2 had a higher diagnosis rate of coronary heart disease (CHD), including when combined with AH. The majority of patients in both groups showed resolution of their pneumonia symptoms based on CT data; however, the statistical significance of the differences in this sign between the groups was not demonstrated.

There was a propensity for the left ventricle's posterior wall to be thinner in group 2. This tendency accelerated after group 2's LV end-diastolic size, length, and stroke volume were all reduced, along with the cardiac index, following indexing to BSA. LV ejection fraction (EF), type of geometry, and myocardial mass did not differ significantly between groups. At this point in the trial, neither a decrease in left ventricular ejection fraction nor second-degree or higher mitral regurgitation were present in the patients. Group 2 was characterized by a smaller volume of LA emptying, a lower rate of FC MK e', and a smaller integral of the linear flow velocity in the LV outflow tract.

Significant intergroup differences in the structural and functional parameters of the right ventricle (RV) were found when evaluating the right heart (Table 4). Specifically, group 2's RV area, transverse dimensions, and sphericity indices were larger, and the fraction of changes in the RV's area and the tricuspid ring's speed S' was below average. Long-term following the disease, there was a 57.5% frequency of reduction in the overall longitudinal distortion of the left ventricle. There was a significant difference in the mean LV GLS

International Journal of Medical Sciences And Clinical Research
(ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

between groups 1 and 2 (-17.6 ± 1.9 vs. –21.8 ± 1.2%; p < 0.001).

Discussion: An analysis of the right heart in group 2 showed that the pancreas differed structurally from group 1 in terms of area, transverse dimensions, and sphericity indices. Group 2 had poorer pancreatic systolic function indicators, as evidenced by a decreased pancreatic percentage of change area and a slower-than-average tricuspid ring speed. The second group exhibited inferior LV diastolic function indicators, as demonstrated by a reduced left ventricular emptying volume and a slower-moving fibrous ring of the mitral valve e'. In addition, group 2's integral of the linear flow rate—which represents the LVOT's pumping function—was likewise smaller than group 1's. Despite the fact that in this group the indices of end-diastolic size (EDS) and LV length were lower, significant differences in EF We didn't receive the LJ.

Magnetic resonance imaging (MRI) indicates that in convalescents recovering from COVID-19, the frequency of a decrease in the index of total longitudinal deformity increases from 2% prior to three months after the conclusion of the disease to 30% during the course of three to six months. [9]. S. Mahajan et al. reported comparable results using transthoracic echocardiography 1–1.5 months after discharge: 29.9% showed a decrease in LV GLS, with a mean value of 19.7 ± 4.6%. [10]. We found that the frequency of LV GLS declines in the long-term period following the disease was 57.5%, which is much higher than the results reported by S. Mahajan et al. and the frequency of LV GLS deterioration during MRI [9]. However, it should be noted that such a comparison is rather rough - and due to the low comparability of the clinical characteristics of patients (not all observed by S. Mahajan et al. had a symptomatic course of COVID-19.

In our patients, the mean value of LV GLS after three months of discharge was -20.3 ± 2.2% (total group before separation), and in terms of dynamics, it deteriorated significantly in a year compared to the survey data three months later (–20.3 ± 2.2 vs. –19.4 ± 2.7%; p = 0.001) [3]. Despite the fact that Chinese patients are older (59 ± 13 years) and stay in the ICU more frequently (18.9%), the value of LV GLS after three months of discharge in the observation of Chinese colleagues of 46 patients who underwent COVID-19 was –26.6 ± 4.4% [11], which is better than that obtained by us. A contribution to the differences in the results of our studies could be made by the difference in vendors [12] - colleagues used the Philips Medical Systems, Andover, MA, USA system.

Prospective follow-up of 58 patients in the COVID-19 cohort When comparing MCH Lassen et al.'s findings two months following hospitalization to hospital data, LV GLS did not significantly improve (–17.4 ± 2.9 vs. –17.6 ± 3.3%; p = 0.6) [13]. This is lower than the values

International Journal of Medical Sciences And Clinical Research
(ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

we found, which might be because the Danish patients were somewhat older—62.5 ± 12.1 years—than ours.

When comparing hospitalization data with a single center follow-up of 40 patients in the Netherlands FMA van den Heuvel et al. within 4 months of release from the hospital, a trend toward an increase in LV GLS was observed (-18.5 versus -19.1%; p = 0.07). The investigated cohort was older than our patients, but had less comorbidities, which could account for the positive dynamics [14]. Nevertheless, the results that colleagues obtained likewise fall short of typical norms.

The lack of a unified approach to the formation of study design is generally highlighted when analyzing literature data on the topic of myocardial deformation in the recovery period following COVID-19. This naturally results in heterogeneity of the examined contingent and makes it difficult to compare the findings of different studies. But it's clear that individuals who show a decline in LV GLS with intact LV EF even a year after pneumonia need close observation to avoid or promptly identify subsequent episodes of heart failure, LV dysfunction, or arrhythmia.

The data show that additional research is required to determine the cardiovascular status of individuals who have recovered from COVID-19 pneumonia. This research should involve collecting more data, performing a subgroup analysis to identify predictors of violations of the myocardium's deformation properties, accounting for the treatment administered during the acute phase of the illness, the impact of concurrent cardiovascular diseases, etc.

CONCLUSIONS

One year after experiencing COVID-19 pneumonia, 58.6% of patients, who initially had normal left ventricular ejection fraction (LV EF), showed reduced global longitudinal strain of the left ventricle (LV GLS). In the group with impaired LV GLS, there was a higher prevalence of men. Additionally, these patients more frequently presented with ischemic heart disease (IHD) alongside hypertension. Furthermore, indicators of left ventricular diastolic function were notably poorer in this group compared to those with normal LV GLS.

REFERENCES

1. Shmueli H., Shah M., Ebinger JE, Nguyen LC, Chernomordik F., Flint N. et al. Left ventricular global longitudinal strain in identifying subclinical myocardial dysfunction among patients hospitalized with COVID-19. Int. J. Cardiol. Heart Vasc. 2021;32:100719. DOI: 10.1016/j.ijcha.2021.100719.
2. Wibowo A.,Pranata R., Astuti A., Tiksnadi V.V., Martanto E., Martha JW et al. Left and right ventricular longitudinal strains are associated with poor outcome in COVID-19: a systematic review and meta-analysis. J. Intensive Care. 2021;9(1):9. DOI: 10.1186/s40560-020-00519-3.

International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

3. A.T. Ahmedov, F.J. Kamolov, J.R. Sharipov, L.A. Narziev. (2023). PREDICTORS OF CARDIOVASCULAR COMPLICATIONS IN PATIENTS WITH CHRONIC ISCHEMIC HEART DISEASE AFTER BYPASS SURGERY. SCIENCE AND INNOVATION IN THE EDUCATION SYSTEM, 2(4), 164–168. https://doi.org/10.5281/zenodo.7787690

4. A.T. Akhmedov, & L.A. Narziev. (2023). PREDICTORS OF CARDIOVASCULAR COMPLICATIONS IN PATIENTS WITH CHRONIC ISCHEMIC HEART DISEASE AFTER BYPASS SURGERY. International Journal of Medical Sciences And Clinical Research, 3(03), 68–77. https://doi.org/10.37547/ijmscr/Volume03Issue 03-10

5. A.T.Ahmedov, F.J.Kamolov, J.R.Sharipov, L.A.Narziev. (2023). ECHOCARDOGRAPHIC FEATURES OF PATIENTS AFTER COVID-19 PNEUMONIA. ACADEMIC RESEARCH IN MODERN SCIENCE, 2(10), 37–41. https://doi.org/10.5281/zenodo.7787702

6. Ahmedov, A., & Kamolov, F. (2023). ECHOCARDOGRAPHIC CHANGES IN PATIENTS WITH A SURVEY OF PNEUMONIA ASSOCIATED WITH CORONAVIRUS INFECTION COVID-19. International Bulletin of Medical Sciences and Clinical Research, 3(3), 110–115. Retrieved from https://researchcitations.com/index.php/ibmscr/article/view/883

7. Akhmedov A.T. (2022). COMPARATIVE EVALUATION OF IMMUNOLOGICAL PARAMETERS OF LABORATORY ANIMALS WITH THYMUS AUTOIMPLANTATION IN THE DYNAMICS OF OBSERVATION. International Journal of Medical Sciences And Clinical Research, 2(11), 12–18. https://doi.org/10.37547/ijmscr/Volume02Issue 11-03

8. Navruzova, Sh.I., Akhmedov, A.T. “AUTOIMPLANTATION OF THYMUS IN SURGICAL CORRECTION OF CONGENITAL HEART DEFECTS" CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES, - 2021. – Vol. 2.3 - (2021). – P.: 88-98.

9. Navruzova, Sh.I., Akhmedov, AT “"AUTOIMPLANTATION OF THYMUS IN SURGICAL CORRECTION OF CONGENITAL HEART DEFECTS." CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES, - 2021. - Vol. 2.3 - (2021). – P.: 88-98.

10. Ахмедов А.Т., Особенности иммунной системы при врожденных пороков сердца, // EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE. – 2022. Vol. 2 No. 3 EJMMP. – С. 35-40. [Akhmedov A. T., Features of the immune system in congenital heart defects, // EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE. – 2022. Vol. 2 no. 3 EJMMP. – pp. 35-40 [in Russian]

International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

11. Ахмедов А.Т., Сравнительная оценка иммунологических параметров лабораторных животных аутоимплантации тимуса в динамике наблюдения, // EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE. – 2022. - Vol. 2 No. 3: EJMMP. C. 40-45 [Akhmedov A. T., Comparative evaluation of the immunological parameters of laboratory animals after thymus autoimplantation in the dynamics of observation, // EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE. - 2022. - Vol. 2 no. 3: EJMMP. C. 40-45 in Russian]

12. 12. Хидоятов, Б.А. Микроциркуляторное русло кишечника и поджелудочной железы и его особенности при экспериментальном сахарном диабете / Б. А. Хидоятов, А. Т. Ахмедов // Морфология. – 2008. – Т. 133. – № 2. – С. 145-146. – EDN JUTXTT.7. Otto CM, Pearlman AS Textbook of clinical echocardiography. Philadelphia: WB Saunders Co.; 1995:418.

13. A.T.Akhmedov Kh.M.Aberaev Influence of coronavirus infection covid-19 to a echocardographic changes in patients with a surveyof pneumonia // Академические исследования в современной науке. – 2023. - Том 2 № 20. – стр. 57-59

14. AKHMEDOV , A. (2023). FUNCTIONING OF IMMUNE SYSTEM OF BABIES WITH CONGENITAL HEART DEFECTS. Евразийский журнал медицинских и естественных наук, 3(6 Part 2), 103–110.

15. Akhmedov, A., & Aberaev , K. (2023). INFLUENCE OF CONGENITAL HEART DEFECTS IN A FUNCTIONING OF IMMUNE SYSTEM OF BABIES. International Bulletin of Medical Sciences and Clinical Research, 3(8), 15–21.

16. Nuriddinov S.S. (2023). CLINICAL CHARACTERISTICS OF CHRONIC COLSTASIS IN CHILDREN. International Journal of Medical Sciences And Clinical Research, 3(05), 75–83. https://doi.org/10.37547/ijmscr/Volume03Issue05-11

17. Ramadan MS, Bertolino L., Zampino R., Durante-Mangoni E., Monaldi Hospital Cardiovascular Infection Study Group. Cardiac sequelae after coronavirus disease 2019 recovery: A systematic review. Clin. microbiol. Infect. 2021;27(9):1250–1261. DOI: 10.1016/j.cmi.2021.06.015.

18. Mahajan S., Kunal S., Shah B., Garg S.,Palleda GM, Bansal A. et al. Left ventricular global longitudinal strain in COVID-19 recovered patients. echocardiography. 2021;38(10):1722–1730. DOI: 10.1111/echo.15199.

19. Xie Y., Wang L., Li M., Li H., Zhu S., Wang B. et al. Biventricular longitudinal strain predict mortality in COVID-19 patients. front.

International Journal of Medical Sciences And Clinical Research (ISSN – 2771-2265)
VOLUME 04 ISSUE 06 PAGES: 40-48
OCLC – 1121105677
Crossref doi Google Scholar WorldCat MENDELEY
Publisher: Oscar Publishing Services

Cardiovasc. Med. 2021;7:632434. DOI: 10.3389/fcvm.2020.632434.

20. Nagata Y., Takeuchi M.,Mizukoshi K., Wu VC, Lin FC, Negishi K. et al. Intervendor variability of two-dimensional strain using vendor-specific and vendor-independent software. J. Am. soc. Echocardiogr. 2015;28(6):630–641. DOI: 10.1016/j.echo.2015.01.021.

21. Lassen MCH,Skaarup KG, Lind JN, Alhakak AS, Sengeløv M., Nielsen AB et al. Recovery of cardiac function following COVID-19 – ECHOVID-19: A prospective longitudinal cohort study. Eur. J. Heart Fail. 2021;23(11):1903–1912. DOI: 10.1002/ejhf.2347.

22. Van den Heuvel FMA, Vos JL, vanBakel B., Duijnhouwer AL, van Dijk APJ, Dimitriu-Leen AC et al. Comparison between myocardial function assessed by echocardiography during hospitalization for COVID-19 and at 4 months follow-up. Int. J. Cardiovasc. Imaging. 2021;37(12):3459–3467. DOI: 10.1007/s10554-021-02346-5.