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SOI: 1.1/TAS DOI: 10.15863/TAS

International Scientific Journal

Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2021 **Issue:** 09 **Volume:** 101

Published: 08.09.2021 **http://T-Science.org**

QR – Issue QR – Article

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THE INFLUENCE OF DIFFERENT THERAPY METHODS ON THE VOLUME OF POSTOCOVIDAL PULMONARY LOSS

Abstract: *Predictors of 60-day mortality in patients in the early postcovid period were identified, the effectiveness of the use of various medications with theoretical antifibrotic effects was studied in the aspect of preventing the development of postcoid interstitial lung disease. The Fergana Valley model was used to determine the risk of 60-day mortality in the early rehabilitation period in patients who have had COVID-19 associated pneumonia with 50% or more of the pulmonary parenchyma, as well as the limit of the effectiveness of various medications in terms of risk reduction. An algorithm has been developed for the management of patients with COVID-19 associated pneumonia in the early post-infectious period, taking into account the risk of developing pulmonary fibrosis.*

Key words: *COVID-19, postcovid, pulmonary fibrosis, therapy methods.*

Language: *English*

Citation: Dalimov, A. A., Mamarasulova, D. Z., & Yakubov, N. I. (2021). The influence of different therapy methods on the volume of postocovidal pulmonary loss. *ISJ Theoretical & Applied Science, 09 (101),* 242-248.

Soi: http://s-o-i.org/1.1/TAS-09-101-17 ***Doi***: https://dx.doi.org/10.15863/TAS.2021.09.101.17

Scopus ASCC: *2700.*

Introduction

Noteworthy is a prospective, multicenter, observational study of 86 patients who survived severe SARS-CoV-2 already under close supervision in Austria to assess the degree of cardiopulmonary injury. Preliminary results of the preparation for publication presented at this year's meeting of the European Respiratory Society (EPO) [5,6] showed that the majority of patients remained short of breath (37%), decreased diffuse capacity (28%) and CT abnormalities (88%) through 6 weeks after discharge. While 24-week follow-up is still pending, CT abnormalities dropped to 56% after 12 weeks, from 8 at week 6 on CT scan to 4 at 12 weeks on CT scan. It is encouraging that the authors report that pulmonary fibrosis did not occur in any of their patients. There was also an improvement in lung function over the next 6 to 12 weeks.

Radiological imaging findings for COVID-19 pneumonia include ground-glass opacities with or without consolidation, thickening of interstitial tissue, and parenchymal linear indurations that are predominantly bilateral with a preference for the periphery of the lower lobes [12,11,2,3,4]. As with other inflammatory pneumonias, there are foci of edema organizing pneumonia and DAP. In a recent

study comparing CT imaging, interstitial thickening, air bronchogram, uneven interface, coarse reticular pattern, parenchymal streaks, and pleural effusion were more common in the group with fibrosis than in the group in which fibrosis did not persist.

Thus, it has been suggested that interstitial thickening, uneven interface, coarse reticular pattern and parenchymal streaks appearing during the course of the disease may be predictors of pulmonary fibrosis in these patients [12,9,10]. Rapid progress to the "honeycomb", although it was a rarity, but also met [7,8,1].

Materials and methods

The second stage of the study included 217 patients after discharge from the infectious diseases hospital, where they were hospitalized with SARS-CoV2-associated interstitial pneumonia with a lesion volume of 50% or more of the pulmonary parenchyma. The second stage of the study included only patients with a point risk assessment according to the developed scale using MSCT of 2-3 points. According to a scale using USDP, a score of 2-3 points was recorded in 158 patients (72.81%). On average, at the time of admission to the infectious diseases hospital, the volume of the affected pulmonary parenchyma, according to MSCT, was 71.93 ± 0.66%. The duration of the febrile period in patients was 21.73 ± 0.42 days, the duration of hospitalization in the infectious diseases hospital was 20.08 ± 0.28 days. The score for the quality of life on the PCFS scale is 2.64 ± 0.06 points.

Result and discussion

On average, at the time of hospitalization in an infectious diseases hospital, the volume of the affected pulmonary parenchyma, according to MSCT, was 71.93 ± 0.66%. By the end of the infectious period, the volume of the affected lung tissue according to serial MSCT decreased by 57.37 ± 1.23% (to 30.55 ± 0.87%, p <0.001 with the initial data). Over the next two months, the volume of the lesion of the pulmonary parenchyma decreased by another 17.78 ± 5.92% and amounted to 19.01 ± 9.69% (p <0.001).

The score for the compaction of the lung tissue according to the ultrasound scan at the time of inclusion in the study was 17.06 ± 0.29 points. By the end of the 2nd month of rehabilitation, the score decreased to 8.40 ± 0.17 points (p <0.001). The relative dynamics was -122.06 ± 6.06%.

Reflecting the positive dynamics of interstitial lung damage, the saturation value, initially at the time of inclusion in the study, averaged 80.72 ± 0.55%, by the end of the 2nd month of observation increased to 90.99 ± 0.31% (relative dynamics - + 13.87 ± 0.88%). Also, the score for the quality of life on the PCFS scale decreased by 51.65 ± 3.00% and by the end of the rehabilitation period reached an average of 1.15 ± 0.07% (p <0.001 significance of the difference with the initial data).

Analyzing the dynamics of the studied clinical and instrumental parameters in the groups, depending on the method of medical rehabilitation used, it was found that the groups were comparable in terms of the age of patients, the volume of the affected lung tissue, the duration of the febrile period and the length of the hospitalization period in the infectious hospital, clinical characteristics (saturation and quality of life (Table 1)

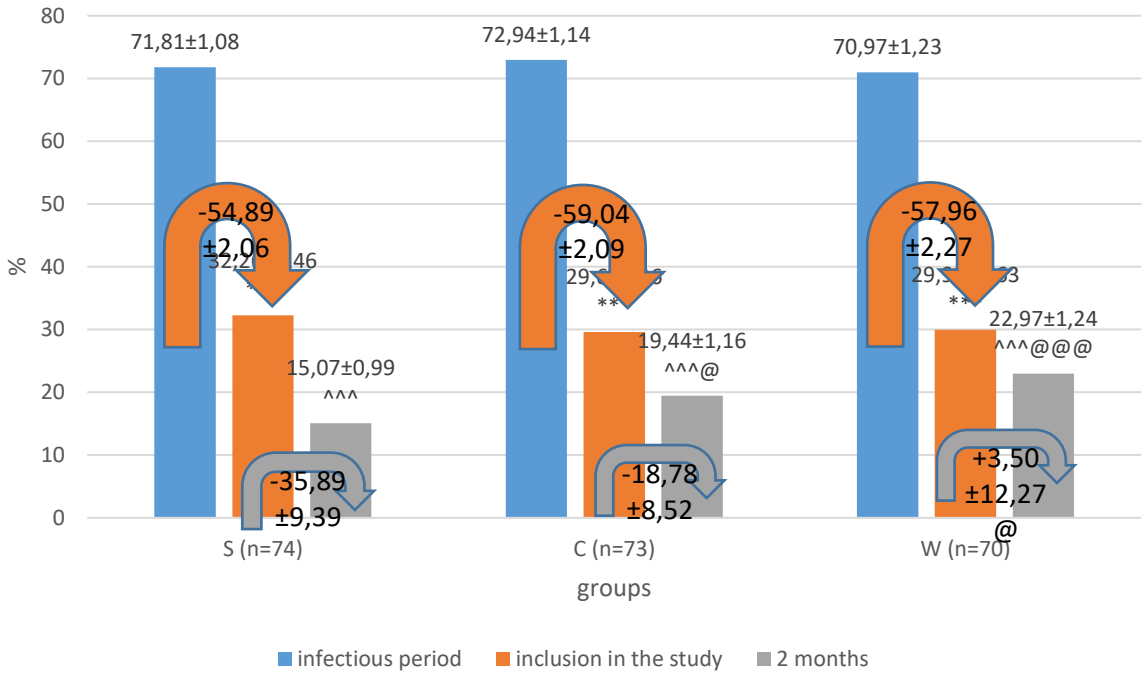
Table 1. Comparative characteristics of study groups depending on the method of rehabilitation used

Indicators	S (n=74)	C (n=73)	W (n=70)	Significance of intergroup differences		
				S-C	S-W	C-W
Age, years	49,47±1,24	49,82±1,32	51,83±1,34	Nr	Nr	Nr
duration of fever, days	22,61±0,75	21,90±0,68	20,61±0,75	Nr	Nr	Nr
duration of hospital infectious disease, days	20,43±0,48	19,79±0,47	19,87±0,51	Nr	Nr	Nr
CT inf stat,%	71,81±1,08	72,94±1,14	70,97±1,23	Nr	Nr	Nr
USDP reab, score	17,30±0,47	17,10±0,52	16,65±0,52	Nr	Nr	Nr
saturation, %	79,69±0,95	81,42±1,00	81,07±0,93	Nr	Nr	Nr
PCFS, score	2,61±0,11	2,64±0,11	2,65±0,11	Nr	Nr	Nr

Dynamic observation showed that in all three groups, the decrease in the volume of the affected pulmonary parenchyma during the treatment of patients in the infectious diseases hospital was comparable (Figure 1). Thus, by the beginning of the study, the volume of the affected pulmonary

parenchyma did not differ in all three groups of patients. Against the background of ongoing rehabilitation measures, by the end of the 2nd month of rehabilitation in all treatment groups, the volume of the affected pulmonary parenchyma continued to decrease significantly, while the most significant effect of rehabilitation measures was observed in group S, in which the volume of the affected pulmonary parenchyma decreased by 35.89% (p <0.05 reliability of differences in relative dynamics with group W, differences in relative dynamics between groups S and C and groups W and C are unreliable). As a result, by the end of the observation period, a significantly lower volume of interstitial lung lesions was achieved in group S compared to the other two groups (p <0.05 - significant difference with group C, p <0.001 - significant difference with group W).

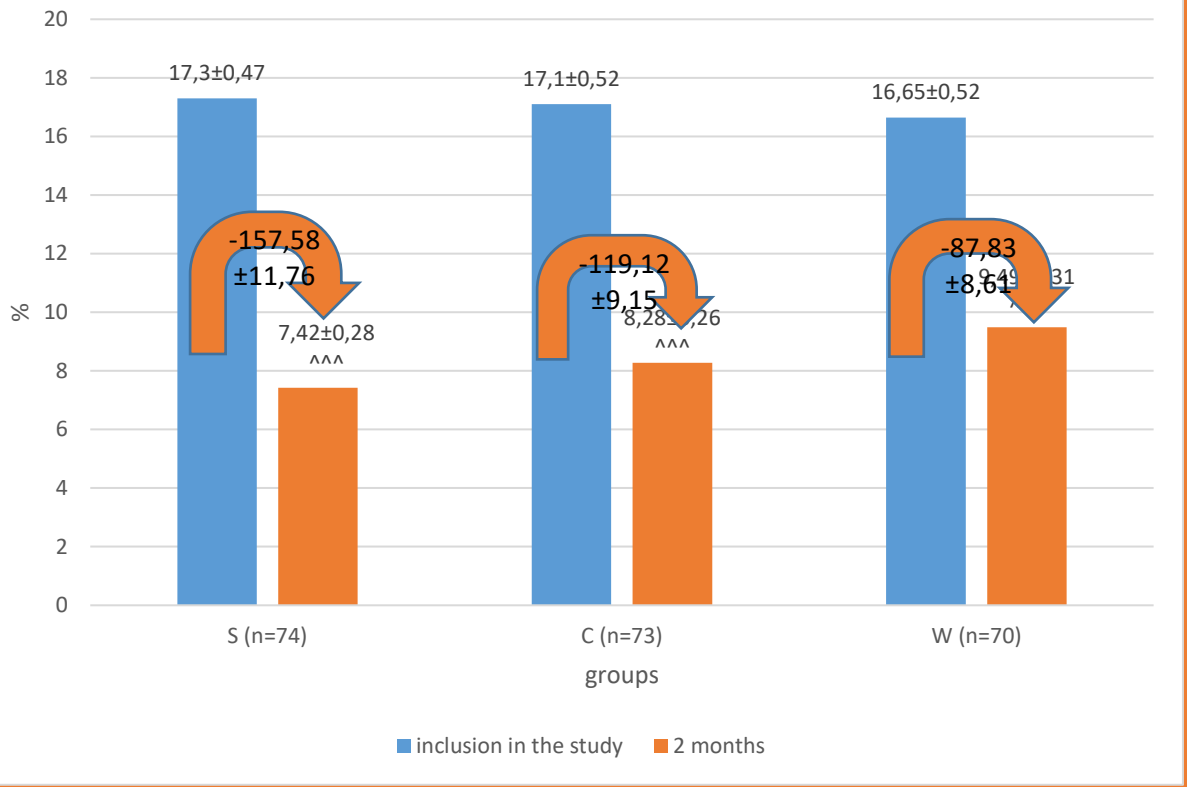
Figure 1. Dynamics of the volume of the affected pulmonary parenchyma in patients after COVID-19-associated interstitial pneumonia with lesions of at least 50% of the pulmonary parenchyma according to MSCT of the chest, depending on the therapy used



*Note: * - reliability of differences with MSCT in the infectious period, ^ - reliability of differences with MSCT at the time of inclusion in the study, @ - reliability of differences with group S, differences between groups K and B are insignificant. One sign - p <0.05, two signs - p <0.01, three signs - p <0.001.*

The scoring of lung tissue compaction according to the ultrasound scan data significantly decreased in all comparison groups (p <0.001 significance of the difference between the scoring scoring of the ultrasound scan at the time of inclusion in the study and at the end of the observation period), the dynamics was maximum in group S (-157.58%), smaller in group C (-119.12%, p <0.05 reliability of the difference in relative dynamics with group S and minimal in group W (-87.83%, reliability of difference in relative dynamics with group S - p <0.001, with group C - p <0.05). As a result, by the end of the second month of rehabilitation, the treatment groups achieved a significantly lower score for USDP compared with patients with a high risk of fibrosis included in the first stage of the study: group S achieved the minimum USDP score between the groups (p <0.001 significant difference with patients of the first stage research), slightly higher - in group C (reliability of differences with group S - nr, reliability of differences with patients of the first stage of the study - p <0.05) and maximum - in group W (reliability of differences with group S - p <0.001, with group C - p <0.01, with patients of the first stage of the study - nr). (Figure 2).

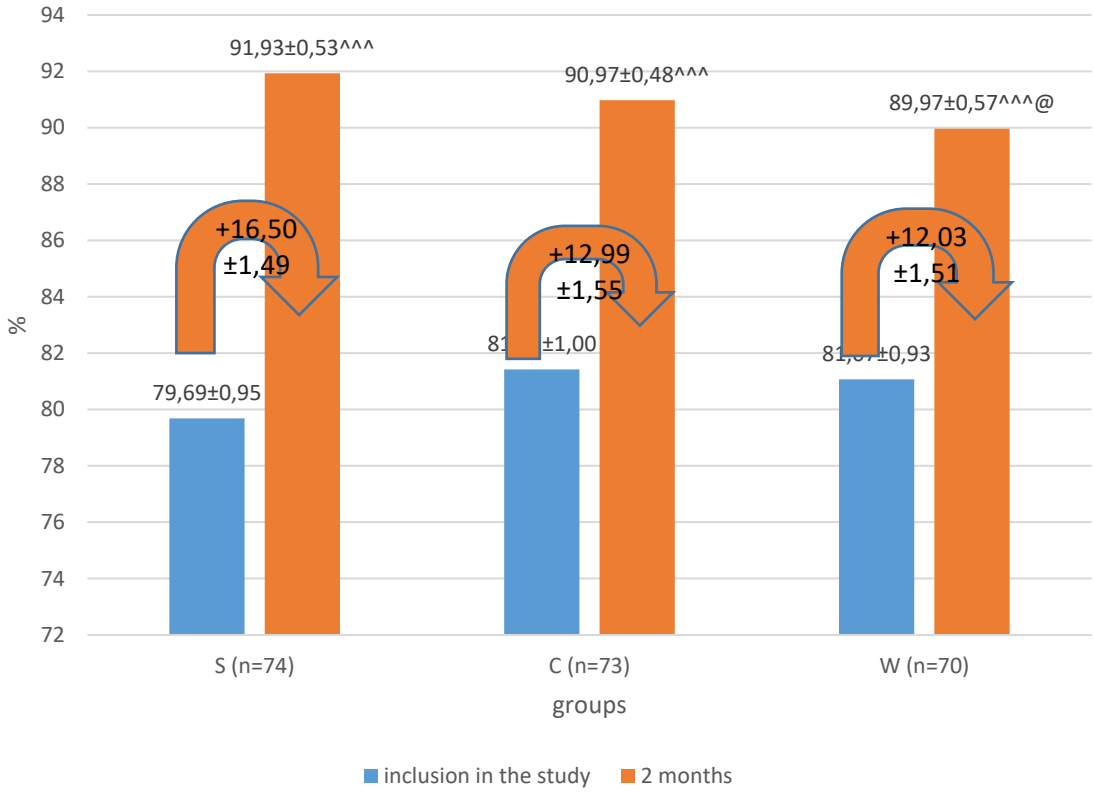
Figure 2. Dynamics of USDP scores in patients who have undergone COVID-19-associated interstitial pneumonia with lesions of at least 50% of the pulmonary parenchyma according to MSCT of the chest, depending on the therapy used



Note: ^ - reliability of differences from MSCT at the time of inclusion in the study, differences between groups are insignificant. One sign - p <0.05, two signs - p <0.01, three signs - p <0.001.

Reflection of a decrease in interstitial damage to the pulmonary parenchyma is an increase in the functional status of the respiratory system. An indicator of the functional capacity of the lungs is the saturation of the peripheral blood. In the present study, saturation in all groups of patients significantly increased during rehabilitation (p <0.001 significant difference between saturation at the time of inclusion in the study and at the end of the observation period, Fig. 3). Although the differences in relative dynamics between the groups did not reach the level of statistical significance, the dynamics in group S was more pronounced; as a result, by the end of the observation period, peripheral blood saturation in group S was significantly higher than in group W (p <0.05). Differences in achieved values between groups S and C and between groups C and W.

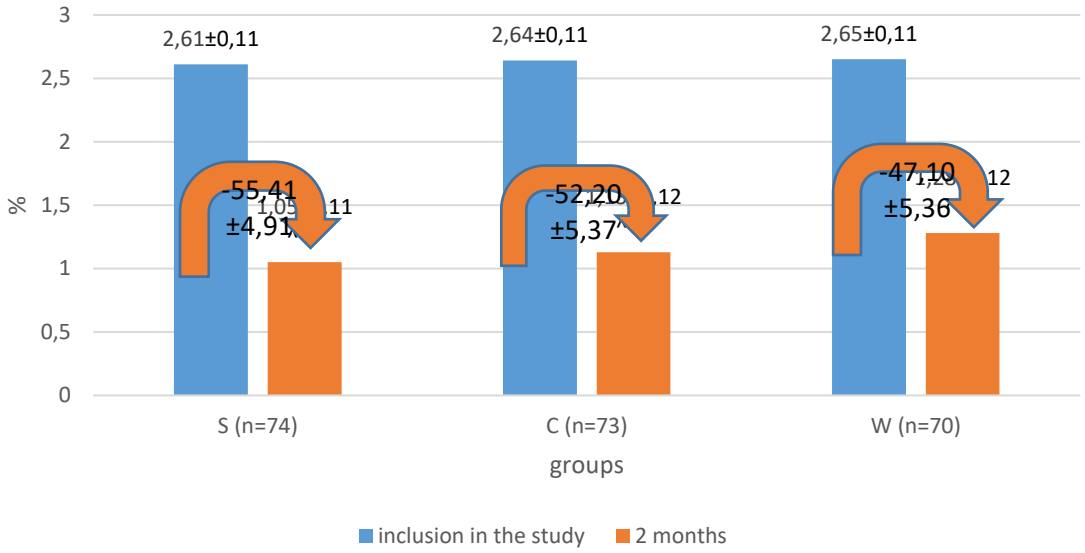
Figure 3. Dynamics of the saturation index in patients who have undergone COVID-19-associated interstitial pneumonia with lesions of at least 50% of the pulmonary parenchyma according to MSCT of the chest, depending on the therapy used



Note: ^ - significance of the difference with MSCT at the time of inclusion in the study, @ - significance of the difference with group C, differences between groups K and B are insignificant. One sign - p <0.05, two signs - p <0.01, three signs - p <0.001.

Improvement in lung function was associated with an improvement in quality of life - a decrease in PCFS score (p <0.001 significant difference between PCFS score at study entry and at the end of the follow-up period). The improvement in quality of life was statistically comparable in all observation groups, although some advantage was noted in group C. As a result, a lower PCFS score was achieved in this group, although the difference between the groups also did not reach the level of significance.

Figure 4. Dynamics of PCFS scores in patients who have undergone COVID-19-associated interstitial pneumonia with lesions of at least 50% of the pulmonary parenchyma according to MSCT of the chest, depending on the therapy used



Note: ^ - reliability of differences from MSCT at the time of inclusion in the study, differences between groups are insignificant. One character - p <0.05, two characters - p <0.01, three characters - p <0.001.

Conclusions

The most significant predictors of the formation of postcovid interstitial lung disease are: the residual volume of the affected pulmonary parenchyma (according to MSCT data) at the end of the infectious period is 20% or more (RR-2.76), the concentration of CRP in the peripheral blood at the end of the infectious period is 45 mg / l and more (RR - 3.78) and preservation of the relative proportion of neutrophils in the population of peripheral blood leukocytes in the early post-infectious period 78% or more (RR - 2.69).

Risk of total mortality within 60 days after the infectious period in of patients who have undergone COVID-19 associated pneumonia with damage to at least 50% of the pulmonary parenchyma is 8.82%. The most significant risk predictors were the volume of pulmonary parenchyma lesions according to MSCT data in the early post-infectious period 20% or more (RR - 7.39, p <0.01) and the duration of the febrile period 21 days or more (RR - 7.40, p < 0.05).

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