

COGNITIVE FUNCTIONS AND HEALTH STATUS IN PREVIOUSLY HOSPITALIZED VERSUS NON-HOSPITALIZED POST-COVID PATIENTS: A PILOT STUDY

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Abstract

Introduction: An increasing amount of evidence indicates that patients after having been recovered from COVID-19 are still experiencing various neurocognitive deficits, as part of the commonly described post-COVID sequelae. These deficits can significantly affect patients' perceived health status and quality of life.

Method: This study assesses global cognitive functions, executive functions, memory, attention, subjective cognitive functioning, perceived health status and quality of life. We compared 16 previously hospitalized (56% males, 44% females, age: 46.1±11.5 years, education in years: 14.9±4.2 years) and 16 non-hospitalized (50% males age: 46.8±15.7 years, education in years: 14.8±2.38 years) post-COVID patients who were matched based on age, education level and time elapsed since the end of COVID-19 infection (respectively 160±140 166±143 days). Objective neuropsychological tests such as the Montreal Cognitive Assessment (MoCA), forward and backward digit spans, Trail Making Test (TMT), verbal fluency test, Frontal Assessment Battery (FAB) and self-report scales such as the Perceived Deficits Questionnaire (PDQ), Post-COVID-19 Functional Scale (PCFS) and EQ-VAS were administered and analyzed.

Results: Previously hospitalized patients performed significantly worse on forward digit span task ($p < .05$), backward digit span task ($p < .05$) and lexical fluency ($p < .05$) compared to non-hospitalized patients. Moreover, hospitalized patients showed significantly higher scores on both parts of PCFS ($p < .01$ and $p < .05$).

Discussion: This pilot study found that previously hospitalized post-COVID patients demonstrate decreased short-term memory, working memory, lexical fluency and perceived quality of life compared to previously non-hospitalized post-COVID patients. Nevertheless, contrasting to previous literature, we did not find significant differences in global cognition, mental flexibility, overall frontal functions, subjective cognitive deficit, and perceived health status.

Keywords: *Post-COVID, cognitive function, subjective cognitive function, health status, quality of life.*

1. Introduction

An increasing amount of evidence indicates that patients after having been recovered from COVID-19 are still experiencing various neurocognitive and affective deficits (Ceban et al., 2022; Crivelli et al., 2022). Post-acute sequelae of SARS-CoV-2 infection is termed post-COVID syndrome or long-COVID. Executive functions, memory, attention difficulties, motor planning and psychomotor coordination impairments are observed after infection and in the longer term (Fernández-de-Las-Peñas et al., 2022; Helms et al., 2020; Heneka et al., 2020; Kaseda & Levine, 2020; Mazza et al., 2021; Nalbandian et al., 2021). Though the acute infection terminates, persistent symptoms often interfere with everyday life, therefore significantly reducing the quality of life of patients. The number of publications is dynamically growing in the field, however, there is still a lack of comparison between post-COVID patients who were hospitalized during their infection with non-hospitalized patients.

Therefore, the main focus of our research is to compare cognitive functioning, self-reported health status and quality of life of previously hospitalized and non-hospitalized post-COVID patients. We hypothesize that the hospitalized group will exhibit decreased cognitive functions (global cognition, executive functions, memory, overall frontal functions) and decreased subjective health status and quality of life compared to the non-hospitalized group.

2. Method

16 previously hospitalized and 16 non-hospitalized post-COVID patients participated in the study. Groups were matched based on age, education level and time elapsed since the end of COVID-19 infection. The hospitalized group consisted of 56% males and 44% females with a mean age of 46.1±11.5 years, 14.9±4.2 years spent in education and a mean of 160±140 days elapsed since the end of their COVID infection. The non-hospitalized group consisted of 56% males, 44% females as well, with a mean age of 46.8±15.7 years, 14.8±2.38 years of education and 166±143 days passed since the end of their COVID infection.

Objective neuropsychological tests such as the Montreal Cognitive Assessment (MoCA) (original: Nasreddine et al., 2005; Hungarian: Volosin, Janacsek & Németh, 2013), forward and backward digit spans (original: Wechsler, Coalson & Raiford, 2008; Hungarian: Rózsa, Kő, Kuncz, Mészáros & Mlinkó, 2010), Trail Making Test (TMT) (Brown & Partington, 1942), verbal fluency test (Tánczos, Janacsek & Németh, 2014), Frontal Assessment Battery (FAB) (Dubois, Slachevsky, Litvan & Pillon, 2000) and self-report scales such as the Perceived Deficits Questionnaire (PDQ) (Sullivan, Edgley & Dehoux, 1990), Post-COVID-19 Functional Scale (PCFS) (Siegerink, Boon, Barco & Klok, 2020) and EQ-VAS (original: The EuroQol Group, 1990; Hungarian: Kaló & Péntek, 2005) were administered and analyzed.

3. Results

During data analysis, independent T-tests were used in case of normal distribution and non-parametric Mann-Whitney U tests in case of violation of assumptions. Between-subject comparisons did not reveal any significant differences in age $t(30) = -0.128$, $p > .05$ (medium-sized effect $r = -0.45$); years spent in education $t(30) = 0.104$, $p > .05$ (medium-sized effect $r = 0.37$) and days elapsed since the end of COVID-19 infection $U = 127$, $p > .05$ (small-sized effect $r = 0.01$). Descriptive statistics showed that 81.3% of the hospitalized sample received oxygen support during hospitalization for a mean of 21.7±23.8 days.

Except for MoCA and PDQ, every score violated assumptions, therefore non-parametric Mann-Whitney tests were used. (*Details are shown on Table 1.*) Between-group comparisons showed that hospitalized patients performed significantly worse on forward digit span task $t(30) = -2.666$, $p < .05$, large-sized effect of $r = -.94$; backward digit span task $U = 72.5$, $p < .05$, medium-sized effect $r = 0.43$; and lexical fluency $U = 61.5$, $p < .05$, large-sized effect $r = 0.52$ compared to non-hospitalized patients. Moreover, hospitalized patients showed significantly higher scores on both parts of PCFS: on textbox score $U = 51.5$, $p < .01$, large-sized effect $r = 0.57$ and flowchart score $U = 70$, $p < .05$, medium-sized effect $r = 0.42$.

Table 1. Between-group data of cognitive measures and self-reported scales.

Test	Hospitalized M (SD) or Mdn	Non-hospitalized M (SD) or Mdn	t or U	df	p	r
MoCA	27	28	95.5	30	0.22	0.25
Digit span: forward	5.63 (0.81)	6.76 (1.48)	-2.666	30	0.012*	-0.94
Digit span: backward	4	5	72.5	30	0.031*	0.43
TMT B time	68.5	53.48	98	30	0.266	0.23
Lexical fluency	11.5	14.5	61.5	30	0.012*	0.52
FAB	17	18	92	30	0.139	0.28
PDQ	16.94 (11.31)	18.38 (12.38)	-0.343	30	0.734	-0.12
PCFS (textbox score)	1	0	51.5	29	0.003**	0.57
PCFS (flowchart score)	2	0	70	29	0.034*	0.42
EQ-VAS	85	85	111.5	29	0.749	0.07

Note. MoCA: Montreal Cognitive Assessment, TMT B time: time measured on part B of Trail Making Test, Lexical fluency: letter S, FAB: Frontal Assessment Battery, PDQ: Perceived Deficits Questionnaire, PCFS: Post-COVID Functional Scale, EQ-VAS: EuroQol Visual Analogue Scale

4. Discussion

This pilot study found that previously hospitalized post-COVID patients demonstrate decreased short-term memory, working memory, lexical fluency and perceived quality of life compared to previously non-hospitalized post-COVID patients. Nevertheless, we did not find significant differences in global

cognition, mental flexibility, overall frontal functions, subjective cognitive deficit, and perceived health status. The differences could be explained by more severe acute infection of the hospitalized patients, by direct effect of the virus to the nervous system, by hypoxia or by side effects of medications for the treatment of infection. Main limitations include small and unrepresentative sample size and the lack of PCR results for patients (patients provided self-reported COVID-test results). Based on the encouraging results, we aim to increase the sample size to 200 participants in order to obtain more representative data and results. Moreover, we intend to compare further affective aspects of patients as well.

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