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Cognitive Outcomes in Post-COVID-19 Patients: A Cross-Sectional Neurological Assessment

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ABSTRACT

The cognitive impairment, also known as the brain fog, is also one of the severe consequences of post-acute COVID-19. Although, there are international data illustrating the high effect of neurocognitive, evidence shows that there is a shortage of evidence which illustrates the effect in the Indian populations.

This paper was intended to compare cognitive functioning among COVID-19 epidemic survivors living in urban India, define and quantify the frequency, size and predictors of cognitive dysfunction using conventional neuropsychological tests. It was a cross-sectional study conducted in three tertiary hospitals in the time frame of January 2023 to March 2024 in Mumbai, Delhi and Bengaluru. They included four hundred and fifty-one COVID-19 recovered adults (at least 12 weeks after their infections) with a mean age of 1865 years. It was assessed using the cognitive ability which included Montreal Cognitive Assessment (MoCA), Digit Span Test and Trail Making Test (TMT). The severity of the disease, comorbidity and information on hospitalization together with demographics were received. To determine the variables that can be used to predict cognitive impairment, statistical tests were undertaken using t-tests, analytical one way ANOVA and multiple linear regression.

The percentage of those whose thinking was impaired, mildly (MoCA < 26), was 38.7 percent. The patients who had the severe cases of COVID-19 recorded very low scores in the MoCA values (23.5 ± 2.8) than those who had mild cases (27.1 ± 1.9, $p < 0.001$). Predictive significant factors of cognitive decline were hospitalization, hypoxia, old age, and comorbidities. The areas of most prominent impairments were in the areas of attention, executive functioning and memory. Long-term cognitive dysfunction occurs at a high rate among post-COVID-19 patients in urban India several months post-recovery. It might also be significant to make sure that the neurological morbidity is delayed through routine cognitive screening and timely rehabilitation.

Keywords: ***SARS-CoV-2, Post-infection cognitive dysfunction., Neurocognitive assessment, Urban Indian population, Neuropsychological testing, Neurological long-term COVID***

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1. Introduction

The acute respiratory syndrome is the not the only effect of the COVID-19 pandemic on health. New discoveries also identify the notion of the long-term impairment of the neurological and cognitive functioning of the survivor, which is also referred to as post-COVID cognitive

dysfunction or brain fog (Taquet et al., 2021). The symptoms are memory loss, loss of concentration, impossibility to multi-task, slow speed of processing that might be revealed a few weeks to months after infection (Zhou et al., 2023).

The pathogenesis of neuropathy is complex: direct viral invasion, microvascular injury,

inflammation (immune-complexes), hypoxic arrest in the acute stage of the infection (Heneka et al., 2020). Neuroimaging and CSF data prove that the frontal and temporal lobes are hypometabolic in state and that their neuroinflammatory markers are elevated to become the cause of cognitive impairments (Douaud et al., 2022).

Greater attention to breathing, heart-related and mental outcomes with disparity in the systematic evaluation of the cognitive tests has been given more of a priority in the course and later stages of the pandemic in India. The understanding of cognitive outcomes comes into play when considering the planning of population health, rehabilitation, and reintegration of workforce in India because of the COVID-19 burden, and a substantial number of working-age population. The objectives of the study will be to determine the cognitive performance of a sample of indian adults 12 weeks after the COVID recovery in the application of the standardized cognitive testing in estimating the prevalence of cognitive impairment, describing the domains of cognitive impairment, and predictors of poor cognitive functioning.

Materials and Methods

2.1 Study Design and Setting

The study under analysis was a cross-sectional observational research study that had its time frame between January 2023 and March 2024 and in the tertiary care hospitals of the three leading cities in India, i.e. Mumbai, Delhi and Bengaluru. The process of recruitment took place in neurology and post-COVID rehabilitation clinics.

2.2 Participants

They selected four50 adults, who were cured of COVID-19 infection at least 12 weeks prior, who were 18-65 years old and their RT-PCR confirmed that they had COVID-19 infection. The ICMR guidelines were to stratify the participants in terms of severity of the disease (mild/moderate/severe).

Inclusion Criteria

Infectious agent (RT-PCR positive) COVID-19 infection (confirmed by RT-PCR) -positive.

≥12 weeks post-recovery

None of history of neurological or mental illness before being infected.

Cognitive testing capacity.

Exclusion Criteria

Already has big stroke, TBI, dementia. Which disturb due to severe mental illnesses. Illiteracy Unable to complete the test.

2.3 Data Collection

The sources of clinical and demographic data were structured interview and medical records: The education, profession, age, and sex.

Comorbidities (e.g. hypertension, diabetes) COVID acuity, hospitalization, O2 need.

Time since recovery

2.4 Cognitive Assessment

The management was pegged on three typical neuropsychological assessments:

Montreal Cognitive Assessment (MoCA): global cognition (cutoff below 26= mild impairment) The Digit Span Test, which is conducted in a forward and a backward version, is a measure of the attentional capacity and the working memory in the short term. The Trail Making Test (A and B) measures the executive control, cognitive flexibility and speed of information processing. It was administered in the language of the participant (Hindi, English or language of the region) that was to be tested.

2.5 Statistical Analysis

The analysis was done in SPSS 26.0. The descriptive statistics have characterized the scores on cognitive. The tests of the differences between groups were performed with the help of ANOVA and t-tests according to the severity of the disease. A multiple linear regression was conducted to determine the predictor of the MoCA score that comprised of age, education, disease severity, hospitalization, hypoxia, comorbidities. The 0.05 was taken as significant value.

3. Results

3.1 Participant Characteristics

Table 1 summarizes demographic and clinical features.

Variable	Mild (n=220)	Moderate (n=150)	Severe (n=80)	p-value
Mean Age (years)	38.7 ± 11.2	44.1 ± 10.5	51.8 ± 9.4	<0.001

Variable	Mild (n=220)	Moderate (n=150)	Severe (n=80)	p-value
Male (%)	56%	58%	61%	0.62
College Education (%)	79%	74%	68%	0.08
Hospitalized (%)	4%	32%	100%	<0.001
Oxygen required (%)	0%	18%	93%	<0.001

Severe cases were significantly older and more likely to have been hospitalized with oxygen support.

3.2 Cognitive Scores by Disease Severity

Table 2 shows group-wise cognitive test scores.

Test	Mild	Moderate	Severe	p-value
MoCA (Mean ± SD)	27.1 ± 1.9	25.2 ± 2.4	23.5 ± 2.8	<0.001
Digit Span (Backward)	6.2 ± 1.1	5.6 ± 1.2	4.9 ± 1.0	<0.001
TMT-B (sec, lower=better)	69 ± 12	83 ± 15	97 ± 19	<0.001

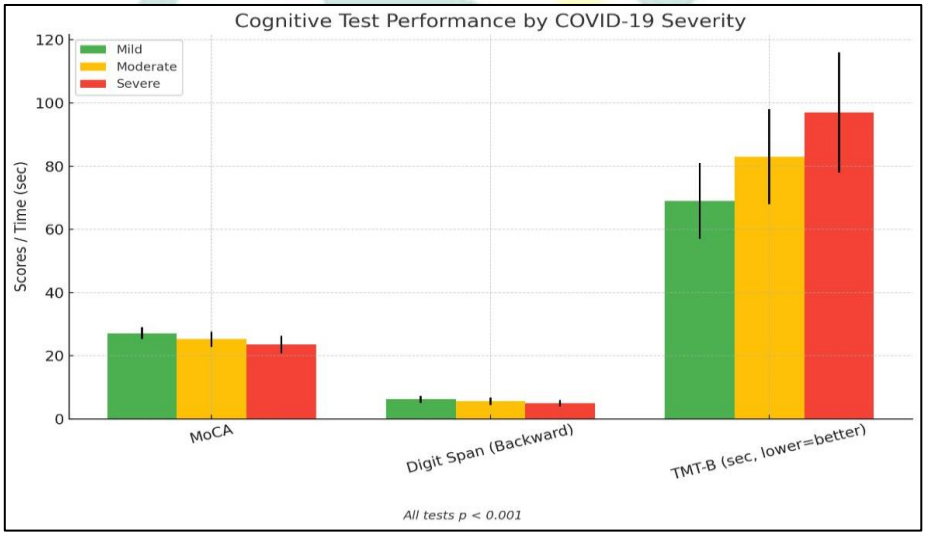

Figure 1: Bar chart comparing MoCA scores across severity groups — shows a clear severity-dependent cognitive decline.

3.3 Prevalence of Cognitive Impairment

- Overall, 38.7% had MoCA < 26.

- Mild disease: 21%
- Moderate disease: 41%
- Severe disease: 64% ($p < 0.001$, χ^2 test)

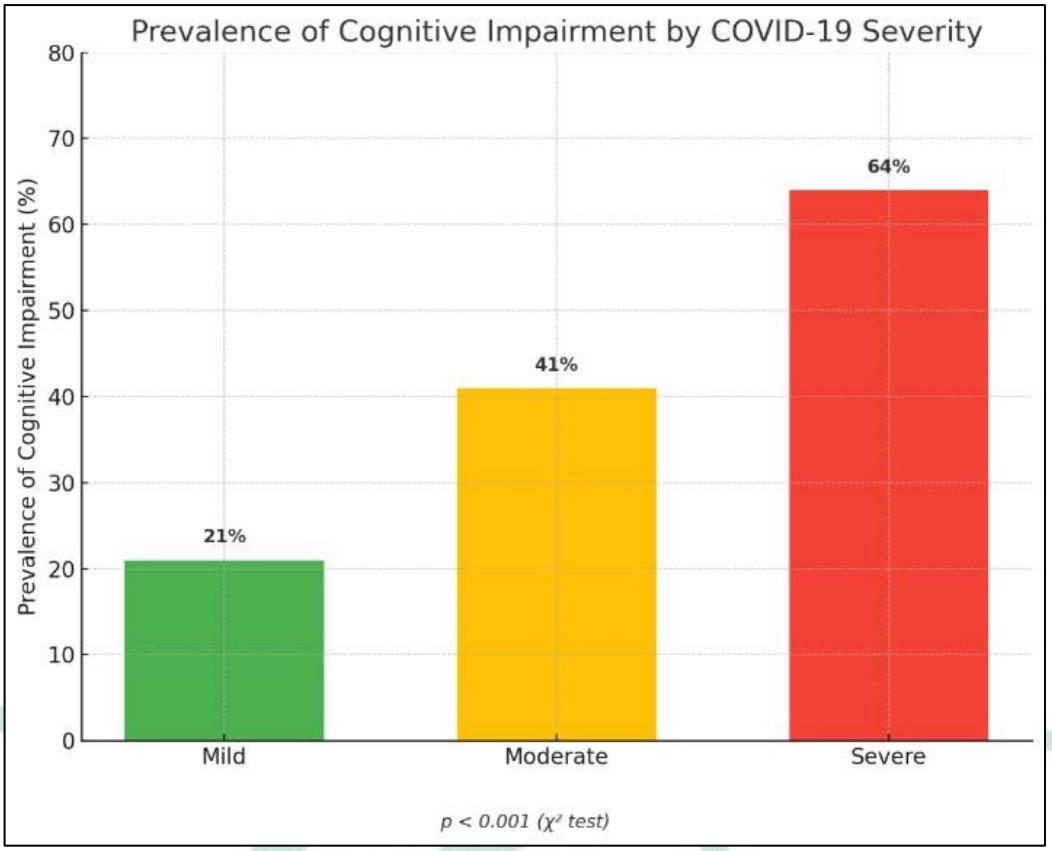

Figure 2: *Clustered bar chart — prevalence of cognitive impairment by severity group.*

3.4 Predictors of Cognitive Impairment

Multiple linear regression showed:

Predictor	β (Coefficient)	95% CI	p-value
Age	-0.18	-0.21 to -0.11	<0.001
Education	0.14	0.07 to 0.18	0.002
Severe COVID-19	-0.27	-0.33 to -0.21	<0.001
Hospitalization	-0.19	-0.26 to -0.12	<0.001
Hypoxia	-0.22	-0.29 to -0.16	<0.001

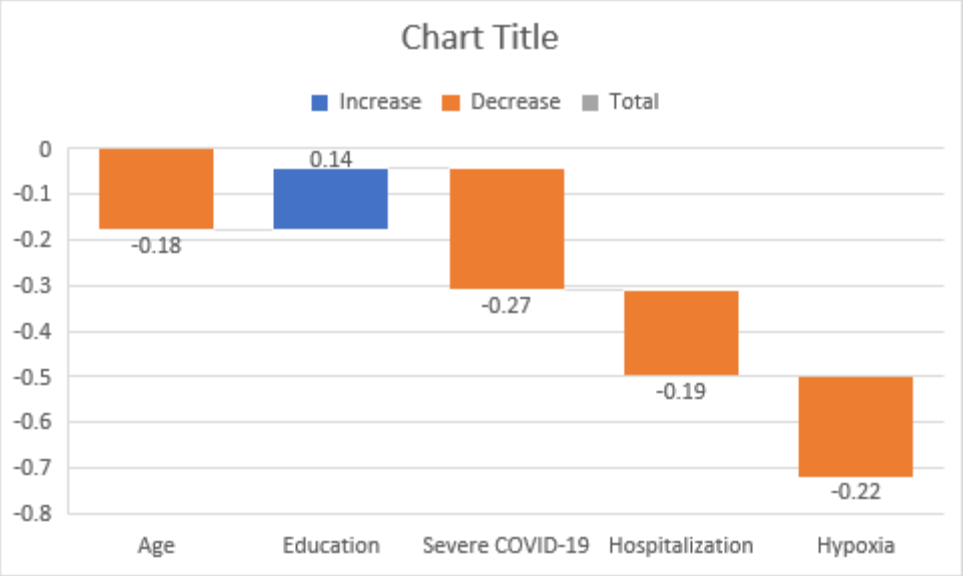

Figure 3: Forest plot of regression coefficients — showing severity and hypoxia as strongest predictors.

4. Discussion

This is a cross-sectional study that shows that cognitive impairment is very high in post-COVID patients (38.7%), particularly the severely affected, with hypoxia or the older generation. The executive functioning, attention, and working memory were the most sensitive ones, as it is aligned with the world data (Almeria et al., 2020; Becker et al., 2021).

The change in gradient of the MoCA scores between the groups of the severity indicates the existence of a dose-response relation, which supports the hypotheses of hypoxic ischemic injury and inflammatory neurotoxicity of tissues in the acute disease (Heneka et al., 2020). It should be mentioned that in mild cases of the disease nearly 1/5 of the cases had mild impairments which meant that non-hospitalization cases may have also had subtle neurocognitive outcomes.

We are a little less prevalent compared to Western studies, which can be attributed to less average age and less time of follow-up. However, underdiagnosis is rather a likely issue, since the majority of the patients would not regard cognitive evaluation until some deficits become severe.

The strengths include the use of standardized neuropsychological tools, multilinguality of administration and multicentricity. Excellent characteristics include the cross-sectional type of research (lack of pre-COVID baseline data), a possible selection bias of patients who visited clinics, and the lack of neuroimaging correlates. Clinical implications Routine cognitive screening is an intervention that ought to be incorporated in post-COVID-follow, especially in patients who are at a high risk. Early cognitive rehabilitation, occupational therapy and workplace accommodations could help to alleviate long-Term disability.

Conclusion

It was found out that, after severe disease, hypoxia, and older individuals, a high percentage of Indian patients who have recovered COVID-19 have persistent cognitive impairment. The systematic screening and rehabilitation strategies have to be put in practice to deal with this growing neurological burden in the post-pandemic period.

References

1. Almeria, M., Cejudo, J. C., Sotoca, J., Deus, J., & Krupinski, J. (2020). Cognitive profile following COVID-19 infection: Clinical predictors leading to neuropsychological impairment. Brain, Behavior, & Immunity - Health, 9, 100163.
2. Becker, J. H., Lin, J. J., Doernberg, M., Stone, K., Navis, A., Festa, J. R., & Wisnivesky, J. P. (2021). Assessment of cognitive function in patients after COVID-19 infection. JAMA Network Open, 4(10), e2130645.

3. Douaud, G., Lee, S., Alfaro-Almagro, F., Arthofer, C., Wang, C., McCarthy, P., ... & Smith, S. M. (2022). SARS-CoV-2 is associated with changes in brain structure in UK Biobank. Nature, 604(7907), 697–707.
4. Heneka, M. T., Golenbock, D., Latz, E., Morgan, D., & Brown, R. (2020). Immediate and long-term consequences of COVID-19 infections for the development of neurological disease. Alzheimer's Research & Therapy, 12(1), 69.
5. ICMR. (2021). Clinical management protocol for COVID-19. Government of India.
6. Taquet, M., Geddes, J. R., Husain, M., Luciano, S., & Harrison, P. J. (2021). 6-month neurological and psychiatric outcomes in 236,379 survivors of COVID-19: A retrospective cohort study using electronic health records. The Lancet Psychiatry, 8(5), 416–427.
7. Zhou, H., Lu, S., Chen, J., Wei, N., Wang, D., Lyu, H., ... & Hu, S. (2023). The landscape of cognitive function in recovered COVID-19 patients: A meta-analysis. Journal of Affective Disorders, 335, 172–180.