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Case Report

Can Covid-19 Infection Lead to Brain Fog? A Case Report

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Abstract

With the omicron variant of covid-19 presenting comparatively mild symptoms in the general population, attention must be paid to the long-term effects of the disease on the neuropsychological functioning of the individual. Cognitive deterioration symptoms are being increasingly recognized after the acute infection. The authors present a case of a 33-year-old, high functioning male, who experienced cognitive deficits as a direct consequence of the Covid-19 infection. This has been done to highlight the cognitive deficits of long covid syndrome (LCS) and its correlation with FDG uptake noted in anterior cingulate, left inferior parietal region, rest of corticol, subcortical grey matter regions and bilateral cerebellar hemispheres. The cluster of these symptoms, called cognitive fog should be addressed in a holistic manner with medical, psychological, and rehabilitative support as a part of continuum of care model.

Keywords: *Brain Fog; Cognitive Fog; Cognition; Covid 19; Neuroscience; Long Covid Syndrome*

Background

More than 30% of the population affected by COVID-19 as asymptomatic cases [1] and approximately 80% of patients hospitalized for COVID-19 may experience post-COVID long term consequences [1,2]. These symptoms are colloquially referred to as 'long COVID' [3]. Brain fog is often explained as a slow or hazy thought process with difficulty in concentration and memory [4]. Numerous studies have emerged showing a causal link between COVID-19 and cognitive dysfunction [5]. In a study of 2,696 COVID survivors, 1680 people (62.3%) reported complaints of Long Covid Syndrome (LCS) out of which 194 people (7.2%) had complaints of cognitive fog, commonly known as brain fog [6,7]. In another study of 29 patients, the investigators found cognitive impairment in more than 59% of the patients 3 - 4 months post discharge [8]. The pathogenesis of brain fog is presently not known with certainty and research is being conducted around it. Speculations involve neuroinflammation via mast cells [9].

These long-term cognitive changes associated with the COVID-19 infection are significant for patient diagnosis, prognosis, curative plan designing, treatment and rehabilitation as a part of the Continuum of Care model [10]. Here, the authors report a case of one such patient who was provisionally diagnosed with brain fog at a premiere tertiary healthcare centre after a Covid-19 infection.

Case Presentation

A 33-year-old high functioning male 'X' was referred from the outpatient services of Neurology to clinical neuropsychology at a tertiary care hospital with the provisional diagnosis of Covid-19 brain fog. The reason for referral was neuro-cognitive assessment of the patient.

As a part of preliminary assessment, X was found to be right-handed, married, living in a nuclear family, and was fluent in both English and Hindi. The patient had been vaccinated with both doses ofCovid-19 vaccine in April'21. He reported having no side-effects of the vaccine. Subsequently, he got COVID but symptoms remained mild. A few days after testing negative, he complained of being in a perpetual hangover state, unable to recall names, faces of people, or events related to recent past. He described 'not feeling like himself' in his day-to-day activities. For instance, he described driving from home to work on a route that he was very familiar with but having some problem keeping on track. In another instance, he was in the middle of a task at work that he was skilled at but he suddenly felt he did not know how to perform the task. Before the referral, a Brain PET-CT scan was done 60 minutes following intravenous injection of 5 - 10 mCi of fluorodeoxyglucose (F-DG). Study was reconstructed and plain positron emission tomography (PET) and fused PET scan and a computed tomography (CT) scan (PET-CT) images were visually interpreted. The findings reveal: 1) mildly decreased FDG uptake noted in anterior cingulate and left inferior parietal region (on cortex ID). 2) Preserved tracer uptake in rest of corticol, subcortical grey matter regions and bilateral cerebellar hemispheres. The final impression of PET-CT was i) Mild hypo-metabolism in anterior cingulate and left inferior parietal cortices with ii) Adv: Clinical Correlation. Such episodes continued for a few weeks before he was referred for a comprehensive neuropsychological assessment. At the time of this assessment, the patient presented problems as follows: problem in attention (directed, sustained and divided) and concentration. The patient reported that nothing felt real to him, he experienced the world in a constant drowsy/dream-like state, similar to having a 'hangover' ("sapna sa chalta hai"). He had difficulty with driving and remembering the route, performing and focusing on his expertise/skilled procedure in which he was proficient, recalling information without effort, visuo-motor coordination, and multi-tasking. The patient mentioned that he was unable to clearly recall names, faces of people, places and events related to his recent past. Focusing hard on something led to headaches and mental fatigue.

Sensory concerns such as sensitivity to bright light were also shared. The patient had also been experiencing changes in mood, behaviour and personality. He expressed experiencing prolonged sadness, anxiety and nervousness. There was also a lack of interest in previously pleasurable activities.

A comprehensive neuropsychological assessment followed a flexible approach of assessment [11] using Indian Validated tools. Selection of tests was based on two parameters: 1) Set of tests of neuropsychological function recommended for assessment of brain fog and 2) Additional set of tests based on his presenting problems. The comprehensive neuropsychological assessment was done keeping the focus on four domains: i) Screening of functions, ii) assessment of Intellectual Functioning iii) evaluation of Neuro-cognitive Functions and iv) assessment of Neurobehavioral symptomatology and Psychosocial Functioning. This included assessment of intellectual functioning, sustained attention and mental flexibility/set shifting processes, verbal learning and memory, visuo-spatial functioning, neurobehavioral symptomatology and psychosocial functioning.

The following tests were used i.e. NEST [12,13], Standard Progressive Matrices (SPM) [14], Indian version of Rey Auditory Verbal Learning test (AVLT) [15,16], Colour Trails test (CTT) 1 and 2 [17,18], Complex Figure Test (CFT) [19,20], HAM-D [21] and HAM-A [22], dysfunctional analysis questionnaire (DAQ) [23] and Personality Trait Inventory [24]. The comprehensive set of tests was completed in a total of 4 hours.

Clinically, the patient was oriented to time and person. His orientation was foggy with respect to place, as he needed guidance for directions to reach the OPD. During the evaluation, he was highly distractible, had difficulty in multi-tasking, and was disoriented. He didn't feel

very alert or aware of things. Tasks required more attention and effort even though the understanding was present. Difficulty in reading, writing letters and words, and performing simple mathematical tasks was also observed.

On objective testing he had intact neuropsychological functions on screening, had mild depressive symptoms on screening (13) and mild symptoms of anxiety on screening (7), an average level of intellectual functioning (IQ = 103), with intact functioning of overall verbal learning: immediate recall (14), delayed recall (13), recognition (15), long term retention (115); intact visual-spatial learning (36), immediate (20.5) and delayed (20.5) visual memory, sustained attention (53), mental flexibility/set shifting (135). No impairment was observed in mood swings, superego, dominance, paranoid tendency, emotionally he was stable on objective functioning, introversion or social desirability. There was evidence of some passivity (-2.6). He had [88, 84, 54, 70 and 62] scores respectively showing 88% impairment in social, 84% in vocational, 54% in personal,70% in familial and62% in cognitive domains, with overall psychosocial dysfunctioning of [358] 71.6%.

[*raw scores obtained on assessment indicated in brackets].

Discussion

The aim of the current study was to present and analyse a novel case of a previously high performing individual post-covid cognitive fog. The authors felt the case was a unique and extreme example of the possible long-term effects of Covid-19 in India and worth reporting. The 33-year-old male came for a neurological evaluation as he was constantly experiencing a drowsy state as if intoxicated by alcohol. A comprehensive clinical assessment was conducted including mental, cognitive and physical parameters. The resulting images of Brain PET-CT were interpreted. Findings showed a reduced FDG uptake in the anterior cingulate and left inferior parietal region. This reduction in metabolic activities suggests areas of reduced blood flow or blockages, similar to those caused by stroke or heart attacks. The anterior cingulate cortex controls a number of cognitive functions like emotion expression, attention allocation and mood regulation [25]. The scan also indicated preserved uptake in the rest of B cortisol, sub-cortical grey matter and bilateral cerebellar hemispheres. This mild hypometabolism is in accordance with results on a series of objective, standardised psychometric assessments to check orientation, screen for symptoms of depression and anxiety. The comprehensive neuro-psychological profile showed a decline in specific domains of cognition. While the patient was oriented to time and person, orientation to place was absent. Problem areas identified were attention, executive functioning and an overall psycho-social dysfunction. The patient showed a decline in attention, Contrary to the study by Jihyang Jun., *et al.* (2021) wherein the patient, although of average intelligence, experienced difficulty performing simple mathematical tasks. The finding of cognitive fog in long COVID is a recognisable symptom cluster.

Conclusion

Research shows cognitive impairment has been ascertained in long Covid survivors via validated and standardized tools, as well as self-report measures. These cluster of symptoms may persist through life and affect physical, cognitive, social, familial and vocational quality of life of an individual. It is thus imperative, in long COVID, cognitive fog should be addressed in a holistic manner with medical, psychological, and rehabilitative support as a part of Continuum of Care model.

Ethics Statement

Ethical review and permission were sought by the Institute Ethical Committee to use the Out Patient data to report the findings. Credentials of the patient have been kept anonymous.

Conflict of Interest

There is no conflict of research among the authors.

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