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COMPLEX HALLUCINATIONS IN COVID-19

Complex Hallucinations in Hospitalized Rehabilitation Patients With COVID-19

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Abstract**Objectives:** To explore the characteristics of hallucinations in hospitalized rehabilitation patients with COVID-19**Design:** Retrospective review using medical records of patients with COVID-19 and admitted to the acute inpatient rehabilitation unit (ARU).**Setting:** A public hospital in southern California, specializing in rehabilitation medicine.**Participants:** Patients with COVID-19 and hallucinations who were consecutively admitted from January 1st to April 30th, 2021.**Interventions:** Not applicable.**Main Outcome Measures:** Types and themes of hallucinations.**Results:** Eight of the 37 patients (21.6%) admitted to the ARU with COVID-19 exhibited hallucinations. All were Hispanic and seven of them were male; their average age was 56.5 (range: 38-71). Seven patients had COVID-19 pneumonia and one developed respiratory distress secondary to Guillain-Barre Syndrome. One patient had posterior reversible encephalopathy syndrome. The average length of stay in the intensive care unit (ICU) was 31.3 days (range: 8-48). Most of the hallucinations occurred during their ICU stay and two continued to their ARU stay. All recalled details of hallucinations with seven exhibiting visual hallucinations, consistent with *peduncular hallucinosis* with or without auditory and/or tactile components. One patient experienced tactile hallucinations. The themes of hallucinations identified to reflect the contents of the hallucinations were patients'

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comfort-seeking, fearfulness, and seeing deceased family members. All patients had impaired cognition at the ARU admission but improved at the discharge. Four patients had depressed mood/anxiety and one had depressed mood alone but without a history of psychiatric illness. ICU delirium was documented in five patients. The negative experience of hallucinations seemed to affect their participation of the ARU stay.

Conclusions: More than 20% of patients with COVID-19 who were transferred to attend inpatient rehabilitation exhibited hallucinations. It remains uncertain if these hallucinations were related to the SARS-CoV-2 infection. Multidisciplinary rehabilitation team should be aware to support patients with COVID-19 who experience hallucinations.

Keywords

Hallucinations, COVID-19, SARS-CoV-2, peduncular hallucinosis, ICU syndrome, delirium

Abbreviations

ARAS	ascending reticular activating system
ARU	acute inpatient rehabilitation unit
BUE	bilateral upper extremities
CNS	central nervous system
COVID-19	coronavirus disease 2019
CT	computed tomography
DSM-5	<i>Diagnostic and statistical manual of mental disorders (5th ed.)</i>
EHR	electronic health record
GBS	Guillain-Barré syndrome
ICU	intensive care unit
LOS	length of stay
MERS	Middle East respiratory syndrome
MoCA	Montreal Cognitive Assessment
MRI	magnetic resonance imaging

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ORCHID	Online Real-time Centralized Health Information Database
PRES	posterior reversible encephalopathy syndrome
RBANS-a	attention subsets from the Repeatable Battery for the Assessment of Neuropsychological Status
RLS	restless leg syndrome
SARS	severe acute respiratory syndrome
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2
TMT A&B	Trail Making Test, part A and part B

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Introduction

Hallucinations are false sensory perceptions not associated with real external stimuli.^{1,2,3} The hallucinatory sensation can involve auditory, visual, olfactory, gustatory, tactile and somatic sensations.⁴ Auditory hallucinations are closely linked to schizophrenia.^{4,5} It has been well-documented that hallucinations can be recognized in neurodegenerative disease, eye disease, and other medical conditions, including drug abuse, medication side effects,^{4,5,6} and delirium. COVID-19 is a multi-organ disease,⁷ involving the central nervous system (CNS), especially in the hospitalized patients,^{8,9} and hallucinations have been increasingly reported in COVID-19.¹⁰⁻²² We report hallucinations seen in hospitalized rehabilitation patients with COVID-19, which resembled peduncular hallucinosis.^{23,24,25} We analyzed the described contents of the hallucinations and discuss the possible pathogenesis of the hallucinations in COVID-19 and their clinical importance in rehabilitation medicine.

Methods

We conducted a retrospective observational cohort study of patients with COVID-19 admitted to a public hospital in southern California for medical rehabilitation. The hospital provides medical care for patients of underserved populations. This study followed the STROBE guidelines²⁶ for reporting observational studies. We reviewed the electronic health record (EHR) of hospitalized patients who were consecutively admitted to the post-COVID-19 acute rehabilitation unit (ARU) from January 1st to April 30th, 2021. With local IRB approval, we extracted and compared medical histories and evaluations of

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all the patients. The informed consent was not applicable due to the nature of the study.

Cognition and depressed mood/anxiety: Cognition was evaluated by speech-language pathologists using three standardized tests at admission and discharge. The Montreal Cognitive Assessment (MoCA)²⁷ was used to screen cognitive dysfunction. The Trail Making Test A & B (TMT A&B) helped examine visual attention and task switching, involving executive function.²⁸⁻³¹ The attention subtests from the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS-a)³² was implemented to explore auditory registration, visual scanning, and processing speed. Based on the electronic medical records documented by the providers' notes and assessments by psychologists, depressed mood, anxiety, and delusion were identified.

Description of hallucinations: Types of hallucinations, delusion, and delirium were reviewed and summarized in Table 1. Music hallucination is a type of auditory hallucination; formication is a type of tactile hallucination; and similarly, *peduncular hallucinosis* is a type of visual hallucination. These descriptions were used as tools to differentiate the types of hallucinations patients with COVID-19 experienced and analyzed by authors MT, SF, and BJ.

Thematic analysis: Thematic analysis is a consistent, systematic way of understanding and processing qualitative information, or narratives using "coding" and interesting features of the narrative data. It can be described in short phrases to represent specific ideas which can be potential themes.³³ It is a qualitative research method³⁴ that can lead to descriptions of consistent patterns of underlying meanings.³⁵ Thematic analysis was used to understand the main ideas that may be common among the descriptions of

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hallucinations that patients with COVID-19 experienced. A few themes were identified to summarize the hallucinations. Not all themes were shared by every patient with COVID-19 and hallucinations.

Results

A total of 37 post-COVID-19 patients were admitted to the ARU during the four months and the comparisons of the patients with and without hallucinations are shown on Table 2. The average age upon their admission to the ARU was 56.2 years with no age difference between patients with and without hallucinations. Those with hallucinations had almost double the length of stay for their total hospitalization compared to those without hallucinations. There were significantly more males with hallucinations ($p < .05$).

Thirty-four (91.9%) patients with COVID-19 in the ARU were Hispanic. All of those who experienced hallucinations were Hispanic. The majority of the patients (18/37, 48.7%) had the “critical” COVID-19³⁶ followed by 24.3% (9/37) of them with “non-respiratory” COVID-19.³⁷ Two patients (5.4%) were not able to be classified as to the severity. Eight of the 37 patients (21.6%) exhibited hallucinations. All patients with hallucinations exhibited “critical” COVID-19³⁶ compared to those without ($p = .007$). All patients with hallucinations required mechanical ventilation. One patient (12%) exhibited Guillain-Barré syndrome who required mechanical ventilation due to severe respiratory muscle weakness.

Among the eight patients with hallucinations, the average ICU length of stay (LOS) was 31.3 days ranging from eight to 48 days (Table 3); patients also had a prolonged stay with the average of 83.8 ± 36.3 days in the hospital prior to the transfer to ARU. None of

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them had history of pre-existing mental health problems. All patients exhibited cognitive impairment based on the ARU initial evaluation and most patients demonstrated improved cognitive test scores at the ARU discharge. Other neurological complications are also listed in Table 3. Despite the severity of illness and dysfunction, all eight patients were discharged home at the end of their ARU stay with overall functional gain and improvement in neurological complications.

The description of the hallucinations and neuropsychiatric complications are listed in Table 4. Delirium was described in five patients and all resolved prior to the ARU transfer, except for patient A. Delusion was noted in two patients. Anxiety was reported in four patients and depressed mood was observed in five patients. Seven patients exhibited complex visual hallucinations as described, and the feature of which was similar to “peduncular hallucinations,” defined in Table 1, as vivid, colorful, and scenic visual hallucinations combined with auditory and/or tactile hallucinations.^{23,24} Five patients exhibited tactile/somatosensory hallucinations. Four patients also experienced an auditory component of hallucinations. The thematic analysis has yielded three themes, *comfort-seeking*, *fearfulness*, and *seeing deceased family*. The content of the hallucinations related to *comfort-seeking* appeared in four patients which seemed to offer pleasant, normative feelings. Five patients revealed the hallucinations of fearful and threatening situations. Hallucinations of six patients resolved spontaneously prior to the ARU admission but they still discussed how the experience of their previous hallucinations had affected them during their ARU stay. Patient A and H had persistent hallucinations during their ARU stay. The hallucinations of patient A lasted for a total of 3 months after his ICU

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stay but they disappeared one month after his admission to the ARU. Patient H continued to have hallucinations at the ARU discharge, 166 days after the diagnosis of COVID-19.

Discussion

SARS-CoV-2 infection affects multi-organ systems, and CNS is also significantly involved in COVID-19.^{8,9,11,37,38} It has been reported in 25% of the patients in a meta-analysis.⁸ Neurological symptoms can be observed up to 73% in the hospitalized patients with COVID-19, and CNS manifestation represented 13% to 40% among them.⁹ As one of the CNS symptoms, hallucination in COVID-19 has been increasingly reported; it can accompany COVID-19 associated neurological complications, such as meningoencephalitis,¹⁰ delirium,¹¹ stroke,¹³ posterior reversible encephalopathy syndrome (PRES),^{14,15} reversible splenial lesion syndrome,¹⁶ acute psychosis,¹⁷ and catatonia.¹⁸⁻²⁰ Hallucinations in the COVID-19 pandemic can appear or be more prominent with premorbid neurodegenerative disorders, such as Alzheimer's disease and Parkinson's disease,^{39,40} psychiatric disease,^{20,41} and Charles-Bonnet syndrome.⁴²

In a single but large referral medical center study, hallucinations were reported around 11% (auditory hallucinations 8% and visual hallucinations 3%).²² An international COVID-19 survey study with participants from 56 countries, 3,762 individuals completed self-reported survey for the 7-month follow-up, the overall prevalence of hallucinations was 23.2%, mean prevalence of visual hallucinations 10.4%, auditory hallucinations 6.5% and tactile hallucinations 3.1%, respectively.²¹ The participants with COVID-19 in this study had various severity from home isolations to hospitalization. In our study, the prevalence of

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hallucinations was 21.6%, which was similar to the overall prevalence of the international patient survey study²¹ although all our patients were seriously sick in the hospitalized setting with a prolonging course. The similarity of prevalence regardless the severity of the disease suggests that hallucinations were not uncommonly seen in COVID-19.

Our study focused on the content of the hallucinations, which revealed that the hallucinations were consistent with peduncular hallucinosis in seven of the eight hallucinatory patients (**Table 1**).^{25,43,44} Peduncular hallucinosis is characterized by vivid, colorful, and scenic visual hallucinations, or visual hallucinations combined with auditory and tactile hallucinations.^{23,24} The term, *peduncular hallucinosis* was coined in 1927 after Lhermitte reported the first case in 1922,^{25,43,44} presenting with complex visual hallucinations and brainstem symptoms. Peduncular hallucinosis is rare as Galetta et al. found 85 cases in their literature review approximately in the past 100 years.⁴⁵ Considering the general prevalence of peduncular hallucinosis, we found surprisingly much more prevailing peduncular hallucinosis among our patients with COVID-19. Although the etiology of peduncular hallucinosis still remains unknown, it is speculated that releasing activities of the cortices cause the hallucinations by impaired function of the ascending reticular activating system (ARAS) in the brainstem.^{24,46} The ARAS arises from neuronal clusters with multiple different neurotransmitters in the brainstem, and activates the forebrain, thalamus, and cortex mainly in wakefulness.^{47,48} SARS-CoV-2 can directly invade into the brain from the olfactory bulb and can disseminate the virus into the amygdala, basal forebrain, hippocampus, striatum, cerebral cortex. Also, the immune responsive pathology of SARS-CoV-2 can affect those regions.⁴⁹⁻⁵¹ Those findings support

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the manifestation of peduncular hallucinosis in COVID-19. Furthermore, the CNS manifestation of COVID-19 can occur without focal brain stem signs^{49,50} that are usually seen in peduncular hallucinosis.^{25,43,44,45} All our patients with hallucinations exhibited cognitive impairment, especially in attention, memory and executive functions, which are common in the CNS symptoms in COVID-19.^{7-9,11, 21,22,49,50,52,53} Although Patient H did not exhibit peduncular hallucinosis, he exhibited tactile and somatosensory hallucinations associated with severe neuropathy and PRES.

Examining the SARS epidemic in 2003, with the same corona virus family of SARS-CoV-2, Cheng et al.⁵⁴ reported 10 cases with psychiatric and psychological complications in the acute treatment phase, and two presented visual and auditory hallucinations. It was speculated that the stress from the illness requiring ICU care, separation from family and high dose steroid use to treat ARDS. Many of our patients were documented receiving a high dose of steroid of dexamethasone. Of note, none of our eight patients were treated with hydroxychloroquine, which was used for COVID-19 and can cause hallucinations.⁵¹ The surrounding social environment resembles between the current COVID-19 pandemic and the SARS epidemic. Patients with COVID-19 suffer similarly with a long period of separation from the family due to hospitalization and infection control-related quarantine, the heightened social stress being in the pandemic, the lockdown of cities, and limited social interaction,⁵⁵ which makes the current COVID-19 pandemic a much more extensive problem than the 2003 epidemic of SARS. Both medical and socio-economic factors seem to contribute to the etiology of hallucinations with COVID-19.

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None of our patients experiencing hallucinations exhibited a history of prior psychiatric illness, but five patients were documented presenting delirium during their hospital stay. Delirium is an acute onset of symptoms including impaired attention, awareness and other cognition with evidence that a direct physiological consequence of another medical disorder (in DSM-5, **Table 1**), which should be differentiated from primary psychiatric disease.^{56,57} In delirium, patients can exhibit hallucinations,^{58,59} and the most common hallucinations in delirium are visual hallucinations.^{57,58} Delirium can be prolonged more than four weeks, after acute medical problems resolves.⁶⁰ Our findings of hallucinations may reflect delirium, but the content of the hallucinations in delirium have been rarely described.⁶¹

All our patients in the study received ICU care with mechanical ventilation. Post-extubation psychosis is considered a part of post-intensive care syndrome, which refers “to physical, cognition, and mental impairment that occur during ICU stay, after ICU discharge or hospital discharge, as well as the long-term prognosis of ICU patients.”⁶² Psychotic symptoms during ICU stay were reported to be associated with delirium, and delirium was seen 40% or more of the patients in ICU.⁶³ Tachibana et al. (2021) reports that 25.9% of patients with delirium consulted to psychiatry presented with hallucinations. Alcohol drinking, benzodiazepine withdrawal, use of angiotensin II receptor blockers, and dopamine receptor agonists were most frequently associated with hallucinations in patients with delirium.⁶⁴ The aforementioned situations were not documented among the eight patients in our study with hallucinations. Based on the reviews of McGuire et al. (2000) and Tachibana et al. (2021), hallucinations might be

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calculated to appear in 10.4% or more of the patients with post-ICU syndrome.^{63,64} In one case series study of post-ICU with mechanical ventilation, Guttormson et al., (2014) reports incidence of hallucinations were 27.1% among the 35 post-ventilator patients who experienced mechanical ventilation greater than 24 hours in ICU, for whom the interview was conducted after ICU discharge in the hospital ward or a long-term ventilator unit.⁶⁵ In other survey studies, the incidence of hallucinations varies from 2.0 to 16%.^{66,67,68}

The results of the thematic analysis indicated three themes: patients' comfort-seeking, fearfulness, and seeing deceased family members. The notion of comfort-seeking reflected the inclination that the hallucinations helped generate positive, pleasant feelings in tactile sensation or to resume of regular daily activities in their own non-hospital context. The theme of fearfulness was most commonly experienced which can potentially lead to post-hallucination distress, anxiety, and depressed mood (patient E). Two patients saw deceased family in their hallucinations which may reflect the desire to have peace and the warm presence of their loved one, commonly noticed in end-of-life dreams and visions.⁶⁹

Hallucinations are not necessarily a manifestation of a psychiatric disease, and most of our patients with hallucinations in COVID-19 were assured that further psychiatric interventions were not indicated. However, for some of the patients, hallucinations caused distress. Obtaining detailed descriptions of the hallucinations can be helpful as opportunities to mitigate motivational and psychological barriers in their participation of the ARU.⁷⁰ The content analysis of the hallucinations can be useful to assess the distress or

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contentment of the patients with hallucinations. Also, the non-pharmacological interdisciplinary team approach in ARU effectively worked to ease and solve the distress of the hallucinations. All our patients recovered well and returned home with the conventional interdisciplinary management in ARU.

Study Limitations

There are two notable limitations of this study. Firstly, this retrospective study had a small sample size of the patients with COVID-19 in a public hospital providing care to underserved patient populations. The extrapolation of the study results to the general population is potentially limited. However, the study is important because of its focus on the under-represented people in our society. Another limitation of the study is related to the consistency of clinical documentation and the use of standardized measures. Thus, the sign, symptoms, and contents of hallucinations might not be completely, consistently documented in the EHR. It is more likely that the hallucinations experienced by these patients were under-reported. Furthermore, full sets of standardized psychological assessments of cognition, depression, and anxiety were not employed systematically as they are not in the protocol of the rehabilitation program at the ARU for regularly implementations. Such limitations may hinder the comparison to similar studies focusing on COVID-19 related hallucinations.

Conclusions

The hallucinations were not uncommon (21.6%) among hospitalized patients with

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COVID-19 who benefitted from conventional medical rehabilitation. The features of the hallucinations seemed to be consistent with peduncular hallucinosis, a type of visual hallucinations that have been rarely observed; the content of hallucinations seems to reflect patients' comfort-seeking, fearfulness, and seeing deceased family members. Further investigation of the hallucinations of COVID-19 is necessary to diagnose and determine the treatment procedures for the hallucinated patients with distress. The hallucinations can be a part of delirium; however, they can be manifestations in the CNS of SARS-CoV-2 infection. The etiology of the hallucinations should be warranted in future studies. Patients with COVID-19 who had experienced hallucinations may still benefit from inpatient medical rehabilitation and the interdisciplinary team approach could effectively manage those patients with the awareness that experienced hallucinations may affect the participation of the medical rehabilitation by patients with COVID-19.

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Conflicts of Interest

None

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Table 1. Types of Hallucinations, ICU Delirium, and Delusion

Term	Definition
Auditory hallucinations	Perceptions of sounds without identifiable external stimuli. They can be single or multiple voices talking to or about the person. Music hallucination is also a type. ^{71,72}
Music hallucinations	Musical hallucinations are complex auditory perceptions in the absence of an external acoustic stimulus and are often consistent with previous listening experiences whereby patients experience formed music without an external source. ^{71,72}
Tactile hallucinations	A type of external bodily hallucinations which involves external bodily, superficial sensations, or simulation of pressure on the skin. They have been associated with substance abuse, toxicity, or withdrawal. ^{4,73}
Formication	A type of tactile hallucination in which the individual experiences the sensation of insects crawling over or under the skin. ⁷³
Somatic hallucinations	Patients report perceptions of abnormal body sensations or physical experiences. ⁴
Visual hallucinations	They manifest as visual sensory perceptions in the absence of external stimuli, can occur in non-psychiatric, neurological diseases, e.g., dementia with Lewy bodies, Parkinson's disease, seizures, migraine, sleep disorders, delirium from the medical diseases, or intoxication of some drugs. ⁴

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Peduncular hallucinosis	These predominantly complex visual hallucinations occur during normal states of consciousness; typically consist of lively, colorful, people, scenes, or animals. ^{23, 74-78} They are with dream-like visual hallucinations intruding on normal consciousness. ⁷⁹
Delusion	They are fixed beliefs that are not amenable to change in light of conflicting evidence.
Delirium	It is a clinical syndrome caused by a medical condition, substance intoxication or withdrawal, or medication side effect that is characterized by a disturbance of consciousness with reduced ability to focus, sustain, or shift attention. ⁸⁰
ICU delirium	A disturbance of consciousness and cognition that develops over a short period (hours to days) and fluctuates over time. It is characterized by impaired short-term memory, impaired attention, and disorientation. Prolonged mechanical ventilation is one of the main contributing factors. ⁸¹⁻⁸³

Table 2. Patients Admitted to the Post-COVID-19 Inpatient Rehabilitation Program

Parameters	Cohort (N=37)		Patients without Hallucinations (n=29)		Patients with Hallucinations (n=8)		Group Comparison
	Mean ± SD (Range)		Mean ± SD (Range)		Mean ± SD (Range)		
Age (year)	56.2±11.2 (27 -		56.2±11.5		56.5±10.6 (38		Not
Length of	63.8±43.1 (6		49.3±32.0 (		116.4±38.0 (52 –		<.0001 [§]
Length of	19.5±13.5 (		16.6±11.0 (		30.0±17.0 (12		.032 [§]
	Frequenc	(%)	Frequenc	(%)	Frequenc	(%)	
Sex							.05||
Female	16 (		15 (51.7		1 (
Male	21 (		14 (48.3		7 (
Ethnicity/Race							Not
Asian	1 (		1 (		0 (
Black	1 (		1 (		0 (
Hispanic	34 (		26 (89.8		8 (100.0		
White	1 (1 (0 (
Severity of							.007
Critical	18 (10 (34.5		8 (100.0		
Severe	6 (6 (20.7		0 (
Moderate	0 (0 (0 (

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Mild	0 (0 (0 (
Non-respiratory [†]	12 (12 (41.4	0 (
Unable to classify [‡]	1 (1 (0 (

* Clinical Spectrum of SARS-CoV-2 infection. (NIH 2021)

† Non-respiratory COVID-19 includes non-respiratory or extrapulmonary manifestation. (AlSamman, 2020; Gupta, 2020)

‡ Unable to classify the severity of COVID-19 due to lack of documentation, but admitted for different rehabilitation diagnosis from COVID-19.

§ Independent-Sample Mann-Whitney U test employed.

|| Fisher-Freeman-Halton Exact Test used.

Table 3. Patients with COVID-19 and Hallucinations (n=8)

Case*	A	B	C	D	E	F	G	H
Age	71	54	38	66	50	50	61	62
Sex	M	F	M	M	M	M	M	M
Length of Stay (Days) (Mean)								
ICU [†] stay:	46	8	45	20	32	48	9	>42
Duration from the positive result of a COVID-19 screening test to ARU admission:								
	104	32	78	63	68	126	60	139
ARU Stay:	51	13	18	21	33	11	56	27
Cognitive Status								
<u>Montreal Cognitive Assessment (MoCA)</u> : the score of ≤ 26 indicates impairment.								
admission	20	22	21	16	11	24	na [‡]	17
discharge	22	22	29	19	22	26	20	27
<u>Trail Making Test, A (TMT A)</u> : scores of >78 show impairment.								
admission	166	49	26	164	63	62	na	183
discharge	60	58	27	157	60	41	71	125
<u>Trail Making Test, B (TMT B)</u> : scores of >273 show impairment.								
admission	312	156	208	na	283	87	na	382
discharge	200	210	208	na	149	74	278	337
<u>Repeatable Battery for Assessment of Neuropsychological Status</u> attention subtests								
admission	60	64	na	na	49	75	na	56
discharge	64	82	64	43	68	94	46	53
Neurological Complications								
Guillain-Barré							+	
Peripheral	+		+		+			+
Neuropathic					+			+

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	<p>moving train car</p> <ul style="list-style-type: none"> • Objects floating in the air 										
B	<ul style="list-style-type: none"> • Saw family members at the bedside, holding and massaging her hands and arms 		+	+	+						
C	<ul style="list-style-type: none"> • Saw himself crawling on the street, thirsty, hungry, and begging for money • A nurse and his brother spoke to him in a hospital in Arizona • Kidnapped into a car that later caught the fire; heard voices telling him that he was the one to die • Saw flames and felt the heat • Saw flashes of lights in ICU and ARU 	+	+	+		+		+			+

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D	<ul style="list-style-type: none"> • Saw family members in the hospital but recognized that they were not present in reality • Saw he was working in a factory, interacting with people, and operating the machine 			+	+			+	+		
E	<ul style="list-style-type: none"> • Saw his deceased brother pulling him back to the earth saying: "<i>Don't leave!</i>" • A friend who was a nurse took him to her home to provide care • Experienced feeding his granddaughter at home while holding her in his arms 	+		+	+		+	+	+	+	+
F	<ul style="list-style-type: none"> • Experienced multiple episodes of 	+	+	+		+		+		+	+

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	standing on the street observing people talking to him while making threatening remarks and harmful gestures									
G	<ul style="list-style-type: none"> Experienced doctors and nurses leaving him alone into a large, deep, and cold container Stood on the street, unable to move while people were walking past him Sitting in a wheelchair, a short person verbally offered to take him to the hospital and pushed his wheelchair This short person also spoke to him on multiple occasions While lying in the hospital bed, 	+	+	+	+	+			+	+

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	saw outside the window a choir singing gospels in front of a church										
H	<ul style="list-style-type: none"> • Experienced multiple abnormal sensations in his UEs including: <ul style="list-style-type: none"> • Ants and finger-tips crawling, • Right upper limb enlarging, with a bone or foreign object protruding out the limb • A mouse giving an electric "chunk" • "Small balls" coming out and "rolling around" on his hand and later associated with severe 		+	?		+					

COMPLEX HALLUCINATIONS IN COVID-19

	<p>pain</p> <ul style="list-style-type: none"> • An additional finger on his L hand moving toward his elbow • Painful liquid existing in right elbow • An abnormal positioning of right upper extremity 										
--	--	--	--	--	--	--	--	--	--	--	--

* Tactile/somatosensory hallucinations.

† The patient was also diagnosed with posttraumatic stress disorder.