

Neurological Complications of COVID-19 Infection in Western Rajasthan: An Observational Study

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Abstract

Background: The most common symptoms of COVID-19 infection involve fever, cough, cold and fatigue. However, the major impact of the virus was identified on the respiratory system of the human but some neurological problems were also identified. The neurological problems identified among the patients of COVID-19 were headache, dizziness, and myalgia. The neurological manifestations could be non-specific and influence the mental health of the individual. The changes in health of patients are having a significant impact on the neurological problem and these problems could have a long-term impact on patients. The studies have shown that neurological problem with patient include post-COVID-19 syndrome. Moreover, the young population that was affected from the COVID-19 virus was experiencing a higher chance of neurological issues that lead to major illness or mental disorder.

Aim: The study aims to identify neurological complications of COVID-19 infection in western Rajasthan.

Material and Methods: It was an observational study that has collected and analyzed the data of neurological patients associated with COVID-19. The study has evaluated the information of patients from Jan 2021 to March 2022 in Hospitals attached with Dr S.N. Medical College, Jodhpur, Rajasthan. The statistical data analysis was performed considering the variables that were presented in percentage. Continuous variables were summarized as median and interquartile range (IQR). All the statistical analyses were performed using SPSS software, version 28.

Results: The outcome of the study has suggested that immediate neurological complication among the COVID patients include anosmia, loss of taste (29.5%), anxiety and depression (9.1%), psychosis (4.5%) and acute ischemic stroke (2.3%). As per the analysis, delayed neurological complications among the patients include acute ischemic stroke (20.4%) followed by the ADEM (11.4%), anosmia, loss of taste (9.1%), GBS (9.1%), and cerebral venous sinus thrombosis (6.8%). Moreover, ADEM patients were treated with corticosteroids (18.2%), GBS patients were treated with IVIG (11.4%), and stroke patients were treated with anticoagulants and antiplatelets (15.9%).

Conclusion: The neurological manifestation among COVID-19 patients is highly prevalent and associated with various neurological morbidities. The high impact of virus is having a direct association with the neurological illness of the patients of different age groups. Large

vessel stroke is frequently associated in the younger adult population. Immune-mediated neurological disorders including GBS and encephalitis can present later in the course of the disease.

Keywords: SARS-CoV-2; COVID-19; neurological complications; cerebrovascular complications.

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Background

COVID-19 is one of the major diseases that has affected the global population and lead to many diseases. The outbreak of COVID-19 was declared as pandemic by the WHO and lead to more than 2 million deaths globally [1]. Mortality rate associated with COVID-19 varies among the different nations and rate of recovery was based on the condition of patients and availability of the critical resources [2]. The most common symptoms of COVID-19 infection involve the fever, cough, cold and fatigue. However, the major impact of the virus was identified on the respiratory system of the human but some neurological problems were also identified [3]. The neurological problems that were identified among the patients of COVID-19 were involving the headache, dizziness, and myalgia [4,5].

According to various clinical studies, it was found that COVID-19 was associated with the neurological problems, and these could have influence on the central and peripheral nervous system of the human [6]. The neurological manifestations could be non-specific and influence the mental health of the individual [7]. The changes in health of patients are having a significant impact on the neurological problem and these problems could have a long-term impact on patients [8,9]. The studies have shown that neurological problem with patient include post-COVID-19 syndrome. Moreover, the young population that was affected from the COVID-19 virus was experiencing a higher chance of neurological issues that lead to major illness or mental disorder [10]. The current study aims to analyze the

clinical spectrum of neurological manifestations associated with COVID-19 considering the characteristics of patients with neurological complications.

Aim

The study aims to identify neurological complications of COVID-19 infection in western Rajasthan.

Method and Material

It was an observational study that has collected and analyzed the data of neurological patients associated with COVID-19. The study has evaluated the information of patients from Jan 2021 to March 2022 in Hospitals attached with Dr S.N. Medical College, Jodhpur, Rajasthan.

The inclusion criteria of patients for study followed adult patients with COVID-19 with neurological symptoms and positive status was confirmed with a real-time reverse transcriptase polymerase chain relation. Apart from this, when the RT-PCR results of patients were not available the CT-scan findings of the patients were considered for including them in the study. The exclusion criteria of patients were children under the age of 18 years and younger, patients with no diagnosis of COVID-19 and patients with life-threatening condition.

The demographic data of patients were considered during the study that involves the age, gender, occupation and education. Moreover, the clinical features, medical interventions, radiological findings and treatment course and outcome of the treatment were also considered for

neurological manifestation. The neurological presentation of study focused on the issues related to ischemic strokes, mental status, hemorrhagic encephalitis, and immune-mediated disorders including meningoencephalitis, Guillain-Barré syndrome (GBS), and acute demyelinating encephalomyelitis occurring in the postinfectious period.

The statistical data analysis was performed considering the variables that were

presented in percentage. Continuous variables were summarized as median and interquartile range (IQR). All the statistical analyses were performed using SPSS software, version 28.

Results

The mean age of patients was 40.95 years (SD=13.14) with, 43.2% (n = 19) were female and 56.38% (n = 25) were male patients.

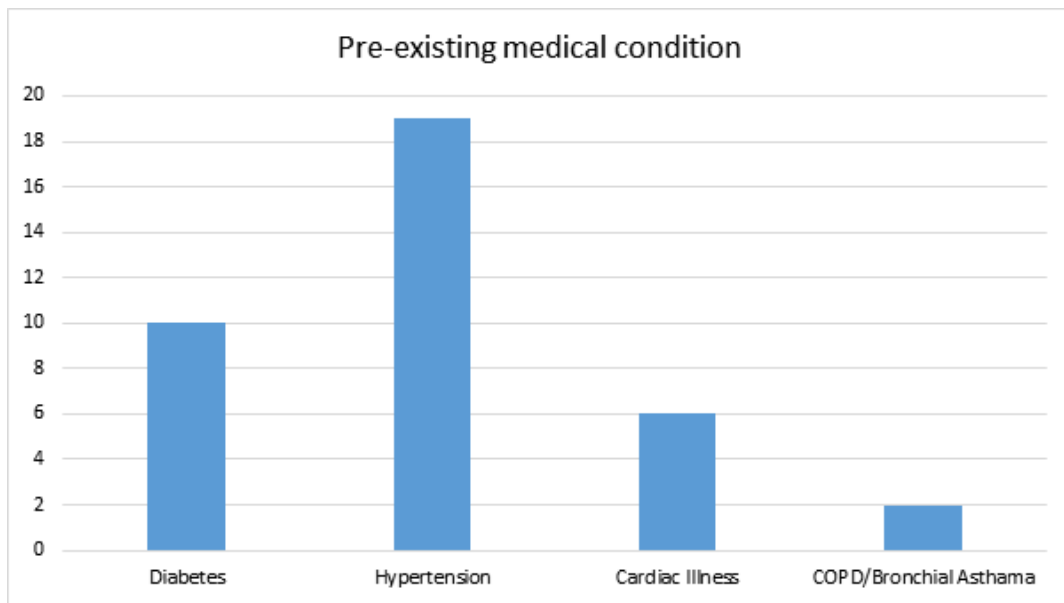


Figure 1: Pre-existing medical condition

Figure 1 shows pre-existing medical condition of patients, and it was found that 22.7% (n = 10) patients were diabetic, 43.2% (n = 19) had hypertension, 13.6 (n = 6) had some cardiac illness, and 4.5% (n = 2) were suffering from COPD/bronchial asthma.

Table 1: Presenting Complain

Fever			Respiratory Distress			Cough			Myalgia		
Days	N	%	Days	N	%	Days	N	%	Days	N	%
3	2	4.5	Nil	6	13.7	2	4	9.1	3	2	4.5
5	7	15.9	2	7	15.9	3	10	22.7	4	7	15.9
6	12	27.3	3	13	29.5	4	12	27.3	5	14	31.8
7	16	36.4	4	12	27.3	5	12	27.3	6	10	22.7
8	4	9.1	5	2	4.5	6	2	4.5	7	7	15.9
10	3	6.8	6	4	9.1	7	2	4.5	8	2	4.5
Total	44	100	Total	44	100	Total	42	95.5	Total	42	95.5
						Missing	2	4.5	Missing	2	4.5
						Total	44	100	Total	44	100

According to table 1 the duration of fever was found for 7 days in 36.4% patients,

followed by 6 days in 27.3% patients and 5 days in 15.9% patients: with an average of

6.52 days (SD = 1.47). Further, respiratory distress was 3 days in 29.5% patients, followed by 4 days in 27.3% patients, and 2 days in 15.9% patients: with an average of 4.10 days (SD = 1.24). Moreover, 27.3% patients complained about having cough for 4 and 5 days, followed by 3 days in 22.7%

patients and 2 days in 9.1% patients: with an average of 5.45 days (SD = 1.23). Finally, 31.8% patients complained about myalgia for last 5 days, followed by 6 days in 22.7% patients and 7 days in 15.9% patients: with an average of 22.14 days (SD = 4.64).

Table 2: Clinical Signs

	N	Min	Max	Mean	Std. Dev
Respiratory Rate (Per Minute)	44	16	32	22.14	4.644
SPO2 % (On Presentation)	44	76	98	89.14	5.593

Table 2 shows that the mean respiratory rate was 22.14/min (SD=4.64) and SPO2% was 89.14 (SD=5.59). Further, cyanosis was diagnosed in 15.9% (n = 7) patients. It was found that 77.3% (n = 34) patients were

hospitalized for COVID-19, and the mean duration of hospitalisation was 13.35 days (SD = 5.37). Moreover, RT-PCR was positive for 72.7% (n = 32) patients.

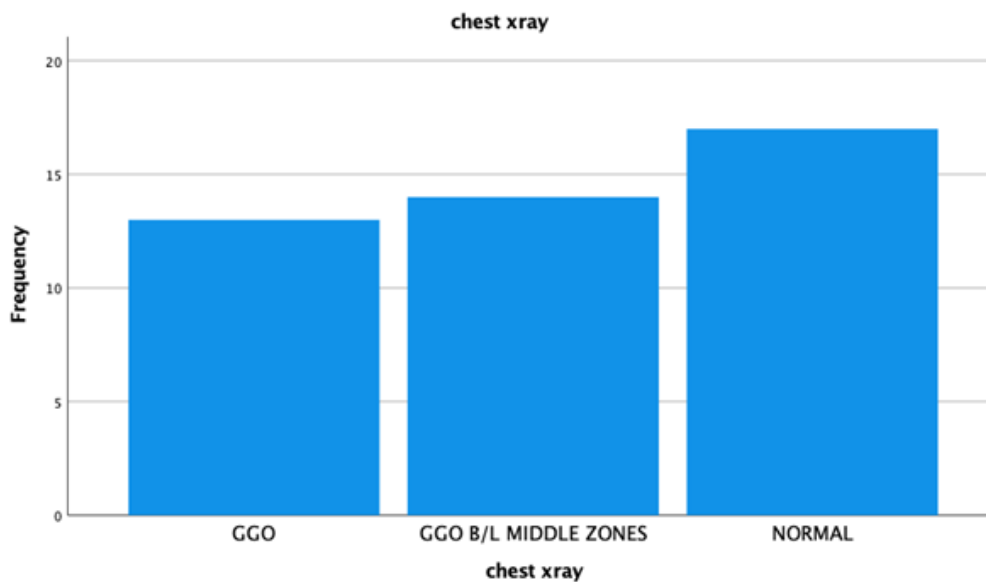


Figure 2: Chest Xray

Figure 2, Chest X-ray report of 38.6% patients was normal, 31.8% showed GGO B/L middle zone and 29.5% showed GGO. Further investigations show that mean CRP was 99.16 (SD = 61.98), mean D Dimers was 1842.02 ng/mL (SD = 1209.68) and mean HRCT chest (CTSS) was 15.91 (SD = 5.04).

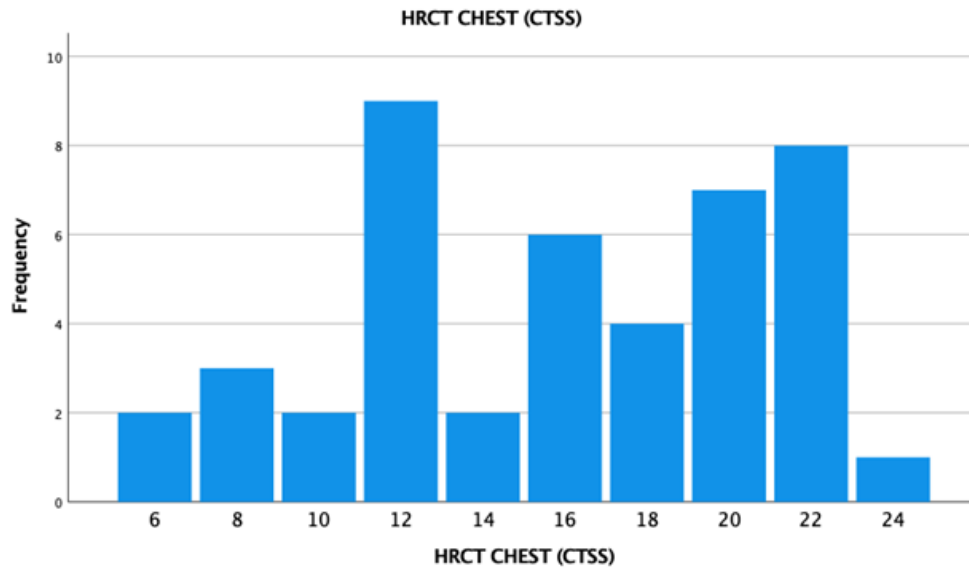


Figure 3: HRCT Chest (CTSS)

Table 3: Immediate Neurological Complications (0-7 Days)

Immediate Neurological Complications (0-7 Days)	N	%
No Complications	24	54.5
Acute Ischemic Stroke	1	2.3
Anosmia, Loss of Taste	13	29.5
Anxiety, Depression	4	9.1
Psychosis	2	4.5
Total	44	100.0

According to table 3 of immediate neurological complications, 29.5% (n = 13) patients suffered from Anosmia, loss of taste 9.1% (n = 4) suffered from anxiety and depression 4.5% (n = 2) suffered from psychosis and 2.3% (n = 1) suffered from acute ischemic stroke.

Table 4: Delayed Neurological Complications (8 To 30 Days)

Delayed Neurological Complications (8 To 30 Days)	N	%
No Complications	10	22.7
Acute Ischemic Stroke- Right Hemiparesis with Aphasia	2	4.5
Acute Ischemic Stroke- Left Hemiparesis	7	15.9
ADEM	5	11.4
Anosmia, Loss of Taste	4	9.1
Anxiety and Depression,	3	6.8
Cerebral Venous Sinus Thrombosis	3	6.8
Encephalitis	2	4.5
GBS- AIDP	3	6.8
GBS- AMAN	1	2.3
Headache	1	2.3
Intracerebral Hemorrhage	1	2.3
Myelitis	1	2.3
Seizures	1	2.3
Total	44	100.0

According to table 4 of delayed neurological complications, 15.9% (n = 7) patients suffered from Acute Ischemic Stroke- Left Hemiparesis followed by the ADEM in 11.4% (n = 5), Anosmia, Loss of Taste in 9.1% (n = 4), Cerebral Venous Sinus Thrombosis (6.8%), GBS-AIDP, and Anxiety and Depression in 6.8% (n = 3).

Table 5: Remote Neurological Complications (More Than 30 Days)

Remote Neurological Complications (More Than 30 Days)	N	%
No Complications	23	52.3
Acute Ischemic Stroke- Left Facio Brachial paresis	1	2.3
Acute Ischemic Stroke- Left Hemiparesis	1	2.3
Anxiety and Depression	8	18.2
Cerebral Venous Sinus Thrombosis	1	2.3
Chronic Headache	2	4.5
GBS- AMAN	1	2.3
Headache	1	2.3
Headache and Seizures	1	2.3
Moya Syndrome	1	2.3
Myelitis	2	4.5
Peripheral Sensory Neuropathy	1	2.3
Seizures	1	2.3
Total	44	100.0

According to table 5 of remote neurological complications, 18.2% (n = 8) suffered from anxiety and depression, followed by 4.5% (n = 2) from chronic headache and Myelitis.

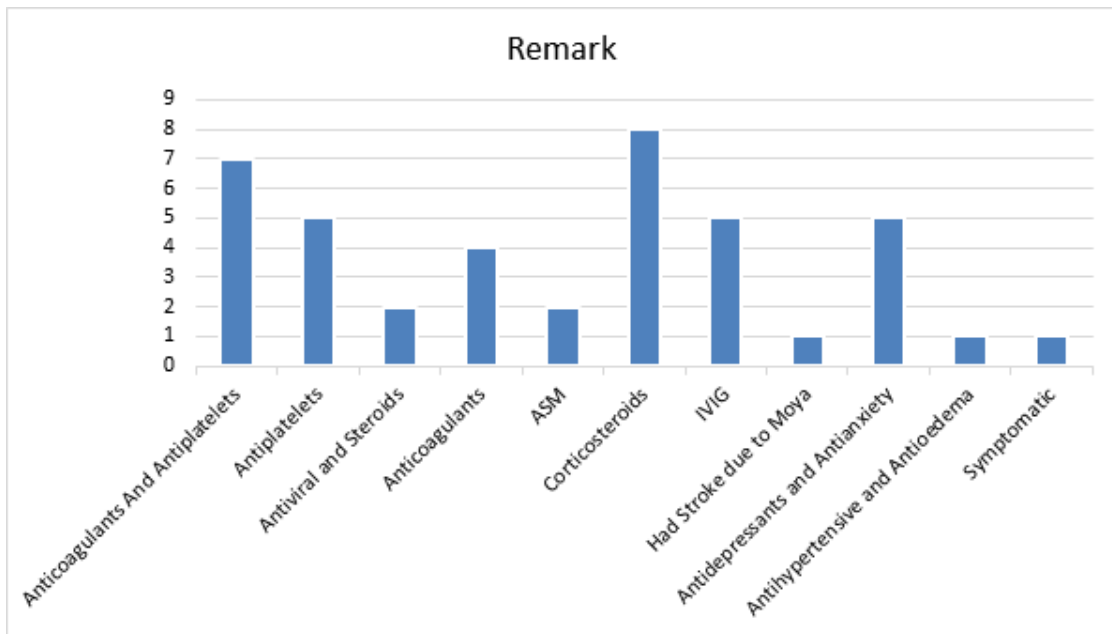


Figure 4: Remark

According to figure 4, 18.2% (n = 8) patients of ADEM were given corticosteroids, 15.9% (n = 7) stroke patient were given anticoagulants and antiplatelets, 11.4% (n = 5) patients of GBS were given IVIG, 11.4% (n = 5) patients were managed with antidepressants, and 9.1% (n = 4) patients were given anticoagulants.

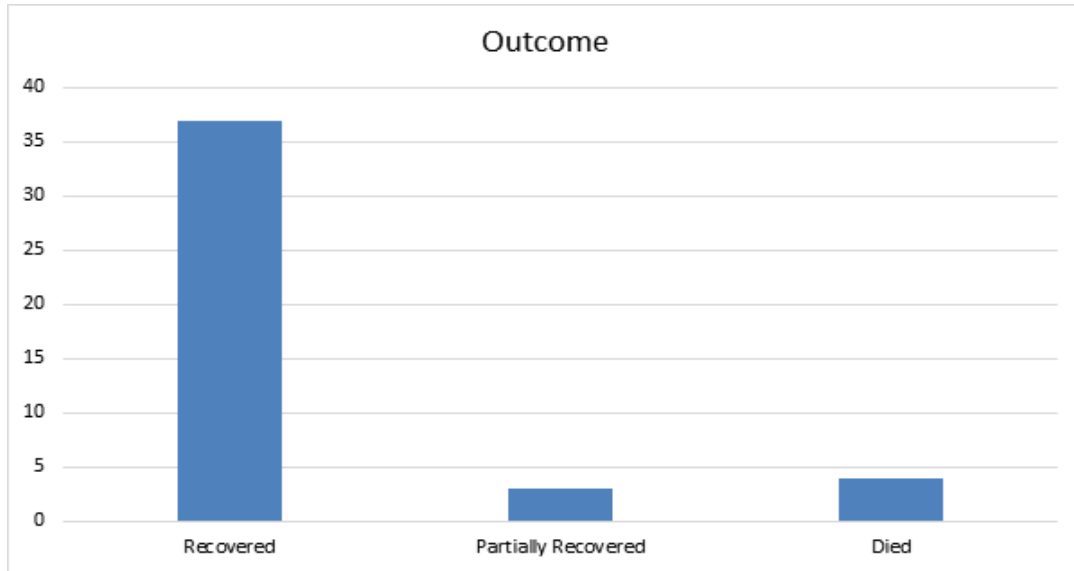


Figure 5: Outcome

According to figure 5, 84.09% (n = 37) patients were recovered, 9.1% (n = 4) were died, and 6.8% (n = 3) were partially recovered.

Table 6: Complications vs Parameters

Immediate Neurological Complications (0-7 Days)	CRP Range (mg/L)		D-Dimer (ng/ml)	
	Elevated (6-20)	Significantly Elevated (>20)	Normal (<500)	Elevate (>500)
Acute Ischemic Stroke	0	1	0	1
Anosmia, Loss of Taste	1	12	3	10
Anxiety and Depression	0	4	0	4
No Complications	1	23	2	22
Psychosis	0	2	0	2
Total	2	42	5	39

As per table 6, CRP of majority (n = 42) of the patients was significantly elevated and 12 out of them had anosmia followed by anxiety and depression (n = 4). Similarly, 39 patients had elevated D-Dimer, out of which 10 suffered from Anosmia and 4 with anxiety and depression.

Table 7: Outcome vs Parameters

Outcome	CRP Range (mg/L)		D-Dimer (ng/ml)	
	Elevated (6-20)	Significantly Elevated (>20)	Normal (<500)	Elevated (>500)
Died	0	4	0	4
Partially Recovered	0	3	0	3
Recovered	2	35	5	32
Total	2	42	5	39

Table 7 shows that all the 4 patients who died had significantly elevated CRP and elevated D-Dimer.

Discussion

From the previous clinical analysis, it was found that COVID-19 was associated with

the neurological problems, and these could have influence on the central and peripheral nervous system of the human. The neurological manifestations could be non-specific and influence the mental health of the individual [11]. The changes in health of patients are having a significant impact on the neurological problem and these problems could have a long-term impact on patients. The studies have shown that neurological problem with patient include post-COVID-19 syndrome. Moreover, the young population that was affected from the COVID-19 virus was experiencing a higher chance of neurological issues that lead to major illness or mental disorder [12].

According to current study, on an average, patients had fever for 6.52 days (SD = 1.47), cough 4.10 days (SD = 1.26), myalgia 5.45 days (SD = 1.23), respiratory rate 22.14 per minute (SD = 4.64) and SPO₂ 89.14% (SD=5.59). Moreover, the mean value of CRP was 99.16 (SD = 61.98), D Dimers was 1842.02 ng/ml (SD = 1209.68) and HRCT chest (CTSS) was 15.91 (SD = 5.04).

Apart from this, outcome of the study has suggested that immediate neurological complication among the patients included anosmia, loss of taste (29.5%), anxiety and depression (9.1%), psychosis (4.5%), and acute ischemic stroke (2.3%). Further, delayed neurological complications among the patients include acute ischemic stroke (20.4%) followed by the ADEM (11.4%), anosmia, loss of taste (9.1%), GBS (9.1%), and cerebral venous sinus thrombosis (6.8%). Moreover, ADEM patients were treated with corticosteroids (18.2%), GBS patients were treated with IVIG (11.4%), and stroke patients were treated with anticoagulants and antiplatelets (15.9%).

According to Chou et al., (2021) [13], the most reported neurological manifestation was altered sensorium (29.6%). Twenty-nine (34.4%) patients were on non-invasive ventilation and a significant number of

patients (n = 22) (26.8%) needed invasive ventilation. The mortality rate was 34.1% and the large vessel involvement in stroke patients was 10%.

Moreover, the study outcome of Shehata et al., (2021) [14] have suggested that the most common self-reported symptoms included headache (1385 of 3732 patients [37%]) and anosmia or ageusia (977 of 3700 patients [26%]). The most prevalent neurological signs and/or syndromes were acute encephalopathy (1845 of 3740 patients [49%]), coma (649 of 3737 patients [17%]), and stroke (222 of 3737 patients [6%]), while meningitis and/or encephalitis were rare (19 of 3741 patients [0.5%]). Presence of clinically captured neurologic signs and/or syndromes was associated with increased risk of in-hospital death (adjusted odds ratio [aOR], 5.99; 95% CI, 4.33-8.28) after adjusting for study site, age, sex, race, and ethnicity [15]. Presence of pre-existing neurological disorders (aOR, 2.23; 95% CI, 1.80-2.75) was associated with increased risk of developing neurological signs and/or syndromes with COVID-19. [16]

Conclusion

From the analysis of the data collected about the COVID-19 patients, the neurological manifestation among COVID-19 patients is highly prevalent and associated with various neurological morbidities. The high impact of virus is having a direct association with the neurological illness of the patients of different age groups. Large vessel stroke is frequently associated in the younger adult population. Immune-mediated neurological disorders including GBS and encephalitis can present later in the course of the disease.

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