The coronavirus 19 (COVID) pandemic continues unabated even after a year since the first case was originally reported in Wuhan district of China in December 2019. Reports of the implications of the pandemic on mental health have been a matter of concern, and various neuropsychiatric presentations have been reported from across the world among people with COVID. Review of previous viral outbreaks has reported low incidence of psychosis (0.9%–4%). In one of the early nationwide surveillance studies conducted in UK, 43% of patients with neuropsychiatric symptoms presented with new-onset psychosis. In this paper, we report a descriptive study of new-onset psychoses in patients detected with COVID-19 infection with an objective to understand the possible association risk factors.

**MATERIALS AND METHODS**

This descriptive study was carried out at a tertiary care teaching hospital in New Delhi during May 2020–December 31, 2020, and included all patients who were admitted with COVID-19 infection and psychosis, between March 2020 and December 2020. Cases of head injury, any neurological or metabolic illnesses, and substance use disorders were excluded. All of them were young male and employed. Most of them had abrupt onset of psychosis with confusion, delusions, hallucinations, agitation, and sleep disturbances. Investigations including inflammatory markers (C-reactive protein) and computerized tomography scans were largely normal. Medications used were mainly benzodiazepines and antipsychotics. Most of the cases resolved within the second week, and follow-up after a month did not elicit any residual symptoms in majority. Diagnosis was acute and transient psychotic disorder (about 75%), bipolar affective disorder (2 cases), and schizophrenia (one). The major findings included nonreactive inflammatory markers, quick resolution of symptoms, requirement of low doses of antipsychotic drugs, and no long-term sequelae.

**Keywords:** COVID, inflammation, neuropsychiatric, psychosis, sequelae
which could result in possible delirium, were excluded. Evidence of COVID-19 infection was confirmed if polymerase chain reaction of respiratory samples tested positive for COVID-19 virus. Diagnosis of psychiatric disorders was made in accordance with the International Classification of Diseases (ICD-10).[9] Permission for conducting the study was obtained from the institutional ethics committee. Informed consent was taken from all the patients, and adherence to CARE Reporting (CARE) guidelines was met in preparing this study.[10] Statistical analysis was carried out using SPSS 25 (IBM, Chicago, IL, USA).

RESULTS

A total of 6198 patients was admitted during the period. Our study was limited to 12 cases of COVID-19 and psychosis, admitted in the facility during that period. This amounted to only 0.19% of all cases of COVID-19 admitted to the center. All of them were male, and the average age was 37.67 (standard deviation [SD] 8.16) years. Range of age was 26–57 years. Ten patients were educated up to 12 class, one 9 class, and one was a graduate. All of them were employed, and except one, all were married. The presentation was varied, and it was interesting that about 58% of cases who had features of psychosis did not have any of the typical COVID 19 symptoms such as fever, cough, or breathlessness [Table 1]. Indeed, they had psychiatric manifestations which led to their hospitalization, and subsequent COVID-19 testing detected their positive status. No significant past history of any mental illness could be elicited in most of them, except two. One was a treated case of Anxiety disorder, and the other had history of Alcohol Dependence Syndrome. Onset was mostly abrupt (transition from nonpsychotic state to full blown psychosis within 48 h), except three cases, where it can be termed as acute (within a week). Sleep disturbances were present in all cases. Other predominant presentations were confusion (92%), anxiety (83%), delusions (67%), and hallucinations (50%). Agitation, disorganized speech, and behavior were observed in nearly two-third of cases, and two of them had indeed absconded from the ward, only to be retrieved later after 2–6 days, with the help of police. Schneiderian first-rank symptoms, considered to be the de jure presentation of classical Schizophrenia,[11] were reported by three cases. Out of them, only one had persistence of these symptoms even beyond the third week and was, later, diagnosed with schizophrenia. They continued to be under monitoring and supervision by psychiatrists, while they stayed admitted in COVID wards. Their COVID management was mostly conservative, and no medical crisis was reported.

After stabilization of clinical status, further details about history, premorbid personality, presence of any predisposing and precipitating stress factors, were sought. Corroboration of facts from family members identified anxiety traits (58%) and dysthymic traits (25%). There was reported schizotypal traits in one case, who eventually was diagnosed with schizophrenia. Five of them had an immediate family member or colleague diagnosed with COVID in the preceding week. Precipitating stressors included loneliness, boredom, isolation, and uncertainty of the illness course, excessive social media usage, and news about COVID illness. Reduced avenues for interaction, recreational opportunities, and restrictions on mobility also added to the stress.

Table 2 lists out the management of these cases. Clinical investigations were mostly normal, except thrombocytopenia in one. Inflammatory markers were tested using C-reactive protein, and nearly all of them (9/12) were nonreactive. Computerized tomography (CT) scans were largely normal, except three cases where it showed regional cerebral atrophy. Precise reason for these findings could not be ascertained, and clinical outcome did not vary with those of others. Benzodiazepines, mostly short acting like lorazepam, were used in nearly all of the cases, in doses ranging from 3 to 12 mg. Antipsychotics used were mainly olanzapine (doses 5–15 mg/day), risperidone (2—6 mg/day), haloperidol (5–15 mg/day), and aripiprazole (10 mg/day). The final diagnosis was made according to ICD-10. Acute and transient psychotic disorder was the most common diagnosis (75%), followed by bipolar disorder (17%) and one had schizophrenia. When followed up after a month, nearly all of them had turned asymptomatic. Only 2 were found to be symptomatic, with depressive symptoms and negative symptoms, and diagnosis in these cases was bipolar disorder and schizophrenia, respectively.

DISCUSSION

Previous coronavirus infections such as severe acute respiratory syndrome (2002) and Middle East respiratory syndrome (2012) have resulted in various psychiatric and neuropsychiatric presentations.[11] In a systematic study and meta-analysis, common presenting symptoms were confusion, anxiety, depressed mood, impaired memory and insomnia. Psychosis as a presentation was relatively uncommon, present in about 2%–4% in acute stages of illness, and 4.4% in postillness stage.[8]

The average age in our study was in mid-thirties. In a retrospective study of association of COVID-19 and first-episode schizophrenia from China, an increased
The association of risk factors contributing to COVID-19 and psychosis is still inconclusive. Studies of previous coronavirus infections have postulated several factors such as elevated inflammatory markers, psychosocial factors, viz., social distancing and quarantine measures, etc., rising social inequities, and steroid usage. Increased inflammatory responses were observed in patients of COVID-19, who presented with short-lasting delirium followed by psychosis. Interestingly, although we had only carried out CRP as the inflammatory marker in our series, none of the cases showed qualitatively reactive levels. Quarantine measures and confinement can lead to elevated anxiety, fear, and a sense of collective hysteria. In a case series of four cases in Spain, psychological distress associated with the pandemic and ensuing governmental measures such as isolation and quarantine were found to increase risk of psychosis. In our study, presence of anxious and dysthymic traits, precipitating stressors such as restricted interactive and recreational opportunities, close acquaintances being detected with COVID-19, excessive media reporting and fear, and a sense of collective hysteria.

Limitations
This study was primarily carried out in urban settings, and the clientele is largely male population. There is a need to

Table 1: Management of COVID-19 patients with new-onset psychosis

| Patient number | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Physical symptoms |     |     |     |     |     |     |     |     |     |     |     |     |
| Fever           | +   | +   | +   | +   | +   | +   | +   | -   | -   | +   | +   | +   |
| Cough           | +   | +   | +   | +   | +   | +   | +   | -   | -   | +   | +   | +   |
| Breathlessness  |     |     |     |     |     |     |     |     |     |     |     |     |
| Others          | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   |
| Psychiatric symptoms |     |     |     |     |     |     |     |     |     |     |     |     |
| Delusions       | +   | +   | +   | +   | +   | +   | +   | -   | -   | +   | +   | +   |
| Hallucinations  |     |     |     |     |     |     |     |     |     |     |     |     |
| Confusion       |     |     |     |     |     |     |     |     |     |     |     |     |
| Agitation       |     |     |     |     |     |     |     |     |     |     |     |     |
| FRS             |     |     |     |     |     |     |     |     |     |     |     |     |
| Insomnia        |     |     |     |     |     |     |     |     |     |     |     |     |
| Anxiety         |     |     |     |     |     |     |     |     |     |     |     |     |
| Others          |     |     |     |     |     |     |     |     |     |     |     |     |
| Past history of psychosis illness |     |     |     |     |     |     |     |     |     |     |     |     |

Drugs: A- aripiprazole, H- haloperidol, O- olanzapine, R- risperidone, CT scan head findings: CA – Cerebral atrophy; FA – Frontal atrophy; N – Normal study. Diagnosis: AD – Acute and transient psychotic disorder; BMD – Bipolar mood disorder; MA – Manic episode; SC – Schizophrenia; Dep – Depression; Neg – Negative symptoms; CBC – Complete blood count; CRP – C reactive protein; NR – Nonreactive; Th – Thrombocytopenia; CT – Computerized tomography; FU – Follow up

Table 2: Physical and psychiatric symptoms of COVID-19 patients with new-onset psychosis

| Patient number | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Physical symptoms |     |     |     |     |     |     |     |     |     |     |     |     |
| Fever           | +   | +   | +   | +   | +   | +   | +   | -   | -   | +   | +   | +   |
| Cough           | +   | +   | +   | +   | +   | +   | +   | -   | -   | +   | +   | +   |
| Breathlessness  |     |     |     |     |     |     |     |     |     |     |     |     |
| Others          | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   |
| Psychiatric symptoms |     |     |     |     |     |     |     |     |     |     |     |     |
| Delusions       | +   | +   | +   | +   | +   | +   | +   | -   | -   | +   | +   | +   |
| Hallucinations  |     |     |     |     |     |     |     |     |     |     |     |     |
| Confusion       |     |     |     |     |     |     |     |     |     |     |     |     |
| Agitation       |     |     |     |     |     |     |     |     |     |     |     |     |
| FRS             |     |     |     |     |     |     |     |     |     |     |     |     |
| Insomnia        |     |     |     |     |     |     |     |     |     |     |     |     |
| Anxiety         |     |     |     |     |     |     |     |     |     |     |     |     |
| Others          |     |     |     |     |     |     |     |     |     |     |     |     |
| Past history of psychosis illness |     |     |     |     |     |     |     |     |     |     |     |     |

Drugs: A- aripiprazole, H- haloperidol, O- olanzapine, R- risperidone, CT scan head findings: CA – Cerebral atrophy; FA – Frontal atrophy; N – Normal study. Diagnosis: AD – Acute and transient psychotic disorder; BMD – Bipolar mood disorder; MA – Manic episode; SC – Schizophrenia; Dep – Depression; Neg – Negative symptoms; CBC – Complete blood count; CRP – C reactive protein; NR – Nonreactive; Th – Thrombocytopenia; CT – Computerized tomography; FU – Follow up

incidence was found (25%), and aged adults (more than 50 years) were found to be vulnerable. In contrast, in a nationwide study in UK, younger patients were more likely to have neuropsychiatric presentations whereas older patients showed predominance of cerebrovascular disorders. In a narrative review of ten patients with COVID-19 and psychosis, the average age was found to be in mid-thirties, and responses to antipsychotics were quick. Most of the case reports of psychosis accompanying COVID-19 have been short lasting. The average duration of psychosis in our study was 11.67 days (SD 4.2). In a case series from Madrid, Spain, subacute onset of symptoms (less than one week), quick recovery (resolution of symptoms within 2 weeks) on low antipsychotic doses, and predominantly referential ideas characterized primary psychotic disorders in COVID-19 patients. In a case series from Madrid, Spain, subacute onset of symptoms (less than one week), quick recovery (resolution of symptoms within 2 weeks) on low antipsychotic doses, and predominantly referential ideas characterized primary psychotic disorders in COVID-19 patients. The average duration of psychosis in our study was 11.67 days (SD 4.2). In a case series from Madrid, Spain, subacute onset of symptoms (less than one week), quick recovery (resolution of symptoms within 2 weeks) on low antipsychotic doses, and predominantly referential ideas characterized primary psychotic disorders in COVID-19 patients.
have more such description of COVID-19 psychosis from across the country to understand the differing risk factors, clinical presentations, course, and consequences of the neuropsychiatric symptoms.

**CONCLUSIONS**

Despite our small sample size, we can tentatively conclude that patients with COVID-19 have a low risk of developing psychosis. Although our follow-up at 1 month showed complete resolution of psychosis in most cases, follow-up of these patients over a longer time will demonstrate the presence of any long-term sequelae.

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**Conflicts of interest**
There are no conflicts of interest.

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