

# The Diverse Neurological Manifestations of the SARS-CoV-2 Pandemic



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## Abstract

SARS-CoV-2 remains an international public health concern and can be encountered in all aspects of healthcare. Although most neurological manifestations are benign, clinicians must be aware and able to recognize more serious conditions that require urgent referral and intervention. Patients at risk for severe cases should be given extra attention given their propensity for neurological and clinical deterioration. This poster highlights the most common and urgent neurological symptoms and diagnoses of the COVID-19 pandemic as well as clinical pearls for their identification.

## Introduction

On March 11th of 2020, the WHO declared Coronavirus 2019 (COVID-19) a global pandemic. Granted coronaviruses are one of the most important causes of the common cold they can also lead to massive outbreaks such as with SARS and MERS. This outbreak has been widely documented to affected the central and peripheral nervous systems. Research has demonstrated that the presence of neurological manifestations is associated with higher inpatient mortality and morbidity rates notably in those over the age of 60. As a result, it is vital that clinicians be vigilant of these signs and promptly identify neurological complications to prevent future clinical deterioration.

## Pathophysiology

Angiotensin-converting enzyme 2 (ACE2) is a functional receptor on cell surfaces expressed in the certain areas of the brain. To enter the blood brain barrier the virus enters via hematological circulation or cribriform plate in the ethmoid bone to bind the ACE2 receptors on neurons and glial cells. SARS-CoV-2 also triggers innate and cellular resulting in cytokine storm. Elevated cytokines and activation of complement and coagulation cascades can progress to acquired coagulopathies and multi-organ dysfunction.

## Clinical Presentation

- 40% of patients present atypically
- Greater risk with elderly population
- Neurological processes can present without respiratory s/s
- Always rule out COVID in acute process
- 80% hospitalized patients present with neurological symptoms early in disease course
- CNS effects are greater in more severe cases

## Risk Factors

- Risk factors for severe COVID associated with high morbidity and 30-day mortality. Consider hospitalization or aggressive monitoring
- Age >65
  - Prolonged immunosuppressants
  - Leukocytosis/leukopenia
  - Elevated D-Dimer
  - Multiple comorbidities
  - American Indian, Black, and Hispanic race/ethnicity
  - Pre-existing neurological/neurodevelopmental disorder

## Central Nervous System Manifestations

- Symptoms
  - Headache
  - B/I headache refractory to analgesics >48 hours
  - AMS
  - Metabolic encephalopathy most common cause
  - Rule out CVA or CNS infection
  - Seizures
- Both sexes, all ages, with and without epilepsy
- Factors: fever, medication dosing, vitamin deficiency, hypoglycemia
- Diagnoses
  - Cerebrovascular disease
  - Ischemic cryptogenic most common, higher NIHSS and mortality
  - Seen younger, less likely to have HTN or prior CVA
  - CVST may initially present as hemorrhage
  - Encephalitis & Meningitis
  - Average 2 weeks from symptom onset, 1/3 normal imaging
  - Meningitis CSF analysis: lymphocytosis and elevated proteins
  - Higher rates of ICU care, encephalitis more common
  - Encephalopathy
    - Mostly seen in ICU, toxic metabolic encephalopathy
    - Taste and smell dysfunction less useful with new variants
    - ANE- symmetric basal ganglia, thalamus lesion with rapid decline
    - PRES- b/I edema occipital/parietal, new onset HTN & renal injury
  - Movement disorders
  - Myoclonus, tremor, ataxia, Parkinsonism, functional psychogenic
  - Good prognosis, seen acute and post infectious
  - Epilepsy
    - Worse neurological symptoms in pre-existing comorbidity
    - Difficulty with obtaining medications, interact with antivirals
  - Transverse Myelitis
    - Both sexes, all ages, post infectious 2-6 W
    - Consistent with classic TM, >4 SC segments
  - Quadriplegia and paraplegia, CSF lymphocytosis & elevated proteins

## Peripheral Nervous System Manifestations

- Symptoms
  - Anosmia, ageusia, CN involvement
  - Most common, without nasal symptoms
  - Decrease with newer variants, improve with decrease viral load
  - All CNS, improve with treatment
  - Neuralgias
    - Retriquer trigeminal neuralgia and herpes zoster, rule out GBS
    - Myalgias
  - Common with viral illnesses, caution with rabdo
- Diagnoses
  - Rhabdomyolysis
  - Keep on differential if presenting with muscle weakness
  - GBS
  - CSF: elevated CSF proteins & pleocytosis, MRI less enhancement
  - Mot common AIDP, 1/5 require ventilation
  - CIN/CIM
  - At risk if on ventilation with failure to ween, mostly seen in ICU

## Diagnostics

- RT-qPCR tests +/- chest CT
- COVID
- Neuroimaging (CT & MRI) +/- spinal views
- Unexplained AMS, encephalopathy, focal neurological deficits, encephalitis, myelitis
- EEG:
  - potential seizure-like activity, epilepsy, acute encephalopathy
  - LP
  - meningitis, encephalitis, GBS, SAH

## Conclusion

Clinicians will encounter a variety of neurological symptoms and diagnoses related to the current pandemic ranging from mild to life threatening. Early detection of neurological and clinical deterioration is key for the greatest neurological outcome. Referral to neurology regarding any neurological symptoms is indicated early on especially if the case is potentially fatal.

Other references available by request

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