NEUROLOGICAL SYMPTOMS
Neurological symptoms have been observed in patients with COVID-19 in China. These symptoms are grouped into several categories, including acute cerebrovascular disease related symptoms, intracranial infection related symptoms, peripheral nervous system symptoms and neuromuscular symptoms. Some patients may also present neuralgia, sensory abnormalities and sphincter disturbances. Neurorlogists need to be vigilant to the symptoms outlined below. A differential diagnosis should always be considered.

Headache
A recent study in Wuhan showed headache as a symptom occurred in 8% of patients but another study from Zhejiang found that 34% of patients complained of headache.

Acute cerebrovascular disease related symptoms
Among confirmed patients with COVID-19, significant numbers of elderly individuals were severely affected. The high D-dimer levels observed in intensive care unit (ICU) patients predispose to a hypercoagulable state. The elderly patients will, additionally, have the usual risk factors for cerebrovascular disease. Considering ACE2 is an entry receptor for SARS-CoV-2, the lower platelet count in critical cases suggests that patients with hypertension infected by SARS-CoV-2 may experience increased blood pressure and higher risk for cerebrovascular haemorrhage. Thus, clinicians at the front line need to involve neurologists for patient management in case of such vascular and other neurological complications in patients with COVID-19.

Intracranial infection related symptoms
Intracranial infection related symptoms such as headache, epilepsy, disturbance of consciousness have been described in COVID-19. Past evidence from SARS revealed possible central nervous system infection by SARS-CoV. Given the fact that SARS-CoV and SARS-CoV-2 share common genetic sequences and use the same ACE2 receptor to gain entry inside the cells, neurologists should consider the possibility of central nervous system infection by SARS-CoV-2 when facing suspected cases. In a patient with COVID-19 and neurological symptoms and signs, imaging and if possible a lumbar puncture with PCR for the SARS-CoV-2 and other viruses should be considered.

The first case of COVID-19 with encephalitis was reported in Beijing, China. This patient presented with convulsions and persistent hicups. Neurological examination revealed slow pupillary response, bilateral ankle clonus, bilateral positive Babinski sign and meningeal irritation. The patient had a normal CT scan. A lumbar puncture showed an increased opening pressure of 330mmH2O, normal biochemical and cytological parameters with a positive PCR for SARS-CoV-2. COVID-19 patients with dysregulated immune system can be co-infected with other pathogens and this may further complicate and deteriorate their condition. Since metagenomics next generation sequencing test on patient’s cerebrospinal fluid (CSF) sample is unavailable, whether the encephalitis was caused by the co-infection of other pathogens is still undetermined. Recently, another rare case of COVID-19 with tuberculous meningitis is reported.

Peripheral nervous system symptoms
A study in Wuhan showed that among patients with peripheral nervous system symptoms, the most common complaints were hypoguesia and hyposmnia. Other peripheral nervous system symptoms include deficit in visual function and neuralgia. So far, electromyography report of COVID-19 with peripheral nervous system symptoms is still lacking.

Muscle damage related symptoms
Some patients showed fatigue, muscle soreness and elevated muscle enzyme levels, which may be related to the inflammation and muscle damage caused by the virus.
CONCLUSION
At present, COVID-19 has been declared a global pandemic but our understanding of the disease is still limited. Given that COVID-19 patients can present with neurological symptoms and signs, neurologists need to be involved, alert and prepared.

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