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Commentary

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Basic Knowledge for Neurologists: SARS-CoV-2 and COVID-19. Are We Well Prepared for Taking Care of Our Patients?

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Commentary

Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), the provisional name of 2019 novel coronavirus (2019-nCoV), is the etiology of respiratory disease of coronavirus disease 2019 (COVID-19) [1]. Human-to-human transmission of the virus has been confirmed. Soon after COVID-19 was designated as a Public Health Emergency of International Concern by the WHO on January 30th 2020, it spreads worldwide rapidly. On March 11th 2020 the WHO declared it a pandemic and now it has spread all over the world involving more than 200 countries and regions. The numbers of new cases and death toll rise exponentially. As to date of April 2nd 2020, the number of infected people with SARS-CoV-2 has exceeded 1,000,000 worldwide. Among them the proportions of health care professional are very high. State Health Departments in Ohio and Minnesota reported that up to 20 percent of those infected are healthcare professionals, a number in line with Italy and other hard-hit regions of the world [2]. Physicians in caring of COVID-19 patients may recognize many of the names in ICU are colleagues, leadership at the hospital, and trusted specialists. The presumable death toll has been estimated to be more than 100,000 in the USA alone.

Coronavirus (CoVs) are enveloped viruses with a single-strand, positive-sense RNA genome and the largest known genome for an RNA virus [3]. They are spherical in shape and approximately 125 nm in diameter [4]. The name of coronavirus was given because of the appearance of CoV virions with spike projections from the virus membrane resembling a crown under electron microscopy.

CoVs can be subdivided into four groups, the alpha, beta, gamma and delta CoVs [5]. The alpha-CoVs and beta-CoVs infect only mammals causing respiratory illness and gastroenteritis. The gamma-CoVs and delta-CoVs infect birds, but some of them can also infect mammals [6]. All CoVs share similar features in the organization and expression of their genome [7]. SARS-CoV (or SARS-CoV-1, caused outbreak of severe acute respiratory syndrome in Asia and China in 2003), MERS-CoV (also known as camel flu, caused Middle East Respiratory Syndrome in 2012) and SARS-CoV-2 belong to the beta-CoVs subfamily. SARS-CoV-1 and SARS-CoV-2 cause respiratory illness by damaging type II pneumocytes sharing the same mechanism of binding angiotensin-converting enzyme 2 (ACE2) receptor, which is primarily expressed on ciliated bronchial epithelial cells [8] of both upper and lower human respiratory tracts [9, 10]; whereas MERS-CoV uses dipeptidyl peptidase 4 (DPP4, also called CD26) as a receptor and infects unciliated bronchial epithelial cells and type II pneumocytes [11].

The first human CoV was isolated in 1965 from the nasal discharge of patients with the common cold and termed B814 [12]. There are several different CoV strains that can infect humans. The highly pathogenic viruses, SARS-CoV-1, MERS-CoV and, currently, SARS-CoV-2 cause severe respiratory syndrome in humans. The other four human CoVs (HCoV- NL63, HCoV-229E, HCoV- OC43 and HKU1) cause only mild upper respiratory illness [13].

SARS-CoV-2 causes COVID-19. Symptoms of COVID-19 appear non-specific and resemble other respiratory infections, similar to those of influenza, including fever, cough, fatigue, sore throat, runny nose, headache and shortness of breath, with ground glass shadowing on radiologic images. The symptoms range from mild to severe respiratory illness. The most common symptoms are fever, cough, and shortness of breath. Elderly, particularly those with chronic medical disorders are vulnerable to SARS-CoV-2 infection and more likely to have poor outcomes [14, 15]. Importantly, symptoms such as dry coughing, fever, and shortness of breath appear to persist longer in patients with COVID-19 than those with uncomplicated influenza. Some patients may have gastrointestinal symptoms such as vomiting or diarrhea. Severe patients may have pneumonia, severe acute respiratory syndrome, kidney failure, and death [14, 15]. Notably, some infected people may have few ambiguous or no symptoms with initially inconclusive RT-PCR nucleic diagnostic study. Incubation time usually is 2-14 days with an average of 5 days and, although extremely rare, it may be as long as 21 days or even longer [16].

SARS-CoV-2 spreads mainly during close contact and via respiratory droplets produced when people cough or sneeze [17, 18] and enters human cells by binding to ACE2 receptors. SARS-CoV-2 may survive in air droplets for up to 3 hours [19] and can be detected in the feces from COVID-19 patients [20]. High load of valid SARS-CoV-2 can be isolated from the throats during the first week after onset of the symptoms of mild COVID-19 patients [20]. SAR-CoV-2 may also infect people via unprotected exposure of the eyes as physicians were infected when only wearing an N95 mask but not wearing anything to protect eyes [21].

Importantly, subclinical infections or infected persons without symptoms may become the source of a majority of infections to shed virus into the environment [22-24]. Therefore, wearing a mask by everybody, particularly in the settings of a hospital or fever clinic, may reduce the cross-infections in the pandemic.

The basic reproduction number (R0) of SARS-CoV-2 has been estimated to be between 1.4 and 3.9 [17, 25]. This means that each infection from SARS-CoV-2 may cause 1.4 to 3.9 new infections when no members of the community are immune and no preventive measures are taken. We are currently in the pandemic COVID-19. How well should we be prepared when taking care of our patients with unknown SARS-CoV-2 infection status? What is the optimal cost-effective measure for us to reduce and stop spreading of SARS-CoV-2 among the naïve individuals to SAR-CoV-2 as well as the death toll of the COVID-19 sufferers?

Large proportions of patients with severe COVID-19 are elderly who may also have underlying chronic medical conditions such as hypertension, diabetes mellitus, chronic obstructive pulmonary disease, cardiopulmonary or cardiovascular disorders, multiple sclerosis, immunocompromised, among others. Those seniors are more susceptible to SARS-CoV-2 infection with poor outcomes [14, 15]. Notably, aging is an independent risk factor for neurologic disorders and neurologic emergencies (e.g. stroke or encephalopathy with altered mentation [26, 27]) can be encountered in patients with COVID-19. Not uncommonly, headaches have been reported in approximately from 5-8% patients with COVID-19 [15, 28, 29]. Previous observations from SARS-CoV-1 suggested the possibility that SARS-CoV-1 may enter the CNS in the CSF [30] and possibly infect brain cells [31].

Increased risk exists for a neurologist to be infected with SARS-CoV-2 if no appropriate personal protection is provided. Aside of the common procedures such as frequently washing hands and keeping social distance, wearing a mask, if possible, by all individuals in the settings of hospital and clinic including patients and hospital personnel may be the most cost-effective measure in reducing cross-infection and the death toll. An opportunity of upgrading personal protective gear (e.g. using an n95 mask with face shield and a gown) may better be offered if a neurologist is called urgently to see a patient with an emergent neurologic condition (e.g. stroke, encephalopathy with altered mentation or GBS) [26, 27, 32] who is in an unknown SARS-CoV-2 status when performing procedures (e.g. ophthalmoscopy optic disks, lumbar puncture or neurophysiologic diagnostic studies) are needed. Diagnostic testing for SARS-CoV-2 should be performed when feasible or patients stabilized, followed by appropriate management accordingly. While awaiting effective therapeutic agents and vaccine to be clinically available, neurologists need to understand and recognize the features of SRA-CoV-2 and COVID-19, and well prepared for better performing our duty and our responsibility.

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