

**Neurology**

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**On being a neurologist in Italy at the time of the COVID-19 outbreak**

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Italy is facing its fifth week of crisis due to the COVID-19 outbreak, with affected patients and deaths near to 70.000 and 6000 respectively [1], numbers that are increasing every day. Whether government imposition of quarantines, travel bans and lockdown throughout the country will have effect in the next weeks in limiting the spreading of this disease has still to be seen. Meanwhile, a great spirit of sacrifice is required to health care personnel and authorities have to manage resource allocation to rapidly increase the number of intensive care beds to assist COVID-19 patients [2]. Although operating rooms and a number of wards have been turned into dedicated intensive units, beds and resources are hardly sufficient to satisfy the needs of so many simultaneously critically ill patients [3,4]. Notably, among infected people about 10% are health workers and their number is increasing, also due to the scarcity of efficacious protective measures.

In this scenario, Italian neurologists are facing two different challenges. First, given the increasing number of COVID-19 cases, they have to deal with patients with neurological complications from the disease. Neurological disturbances such as loss of consciousness, headache, seizures, ageusia, hyposmia, dysphagia, and muscle pain are being increasingly reported in COVID-19 patients [5]. Part of these signs and symptoms may be attributed to cerebral hypoxia due to pulmonary failure. However, it has been hypothesized that COVID-19 can invade the central nervous system (CNS), based on what is known about the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) viruses and the fact that angiotensin-converting enzyme (ACE) 2 receptors the functional receptor for SARS-CoV-2 are found in the central and peripheral nervous system and skeletal muscle [6-8]. Like other respiratory viruses, COVID-19 may enter the CNS through hematogenous or retrograde neuronal routes, although there is increasing evidence that COVID-19 may also invade peripheral nerve terminals [6-7]. Therefore, neurologists should suspect a COVID-19 infection in patients with neurological disturbances and treat the disease's neurological complications.

A second relevant challenge for Italian neurologists is due to the indirect consequences of the focus that the Italian health care system and media have put on the COVID-19 emergency. A great re-organization of the entire public health system is underway in many parts of Italy (of note, the health system is regionalized in Italy and each region has great autonomy to make health-care related decisions) [4]. In many Italian regions, hospitals have been divided in COVID+ and COVID-free ones; several stroke units and neurointensive care units have been re-organized or even closed; and many neurologists have been re-allocated to assist COVID-19 patients. These measures have had a major impact on the organization of the usual emergency networks for myocardial infarction, stroke, and major trauma. The new organization centralizes stroke care, so that patients with stroke will receive acute treatment and hospitalization in a limited number of stroke units and hospitals [9]. This system is different from the current hub and spoke organization and it cannot be seen as a typical mother-and-ship model, because patients will no longer be transferred back to the spokes because these are currently shut down or they have been turned into COVID-19 wards. When this model was proposed and implemented a few weeks ago in the Lombardia region, neurologists feared that these few hub centers would rapidly fill up with patients, leading to a collapse of the system because of the limited availability of beds and personnel. Surprisingly, this has not happened so far, as the number of patients needing acute treatment for vascular, cardiac and neurological events seems to have decreased considerably in the last few weeks.

The phenomenon has been seen throughout Italy, and it is even more surprising considering many patients with COVID-19 have high D-dimer levels and may be at higher risk of cerebrovascular diseases [5]. Italian neurologists are wondering what are the reasons for this, and hypothesize that patients with TIA or mild strokes remain home because of fear about going to the hospital during the outbreak, and that patients with very severe strokes, and those who had pre-existing disability, are also left at home. Another possible explanation is that patients with acute neurological events and severe respiratory distress are not recognized to have a concurrent stroke. Of course, all these

hypotheses will have to be studied but, if these situations are true, we may expect more patients with post-acute complications and long-term disability due to the lack of appropriate acute management and implementation of secondary stroke prevention interventions.

In addition, Italian neurologists and, specially, their patients, are affected by the suspension or decrease of non-urgent medical visits and surgical interventions. This situation affects patients with chronic neurological diseases such as epilepsy, multiple sclerosis, and movement disorders. In addition, access to rehabilitation treatments is limited, both in the inpatient (because rehabilitation beds are now used for patients with respiratory problems) and outpatient settings (whose activity was also heavily reduced). Who should assist these patients, how to treat them, and whether this policy is acceptable for the health system, is at present unclear.

All these issues mean that the COVID-19 pandemic will negatively impact the care of patients with neurological conditions. How big will this impact be is not yet known but neurologists all over the world need to be prepared for it.

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