

tion velocity in the nerves evaluated, and increased minimal F-wave latency in the right L5 and S1 spinal nerve roots; these findings are suggestive of demyelinating polyradiculoneuropathy and compatible with a diagnosis of GBS.

During hospitalisation, the patient was assessed by the pulmonology and neurology departments. He received intravenous immunoglobulins for 5 days plus protocolised treatment for COVID-19: hydroxychloroquine sulfate, antiretroviral drugs (lopinavir and ritonavir), antibiotics (amoxicillin), corticosteroids, and low-flow oxygen therapy. Motor function worsened within 2 days of admission, with the patient developing bilateral facial palsy and dysphagia. Subsequently, neurological and respiratory symptoms progressed favourably.

Although SARS-CoV-2 infection is likely to have caused GBS in our patient, we should not rule out the possibility that co-presence of GBS and SARS-CoV-2 infection may be coincidental. The association between COVID-19 and GBS has not been established, although recent evidence suggest that the virus may be involved in the aetiopathogenesis of GBS.³ Future studies should address the neurological manifestations of SARS-CoV-2 infection.

References

1. Lai CC, Shih TP, Ko WC, Tang HJ, Hsueh PR. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and coron-

avirus disease-2019 (COVID-19): the epidemic and the challenges. *Int J Antimicrob Agents*. 2020;55:105924, <http://dx.doi.org/10.1016/j.ijantimicag.2020.105924>.

2. Matías-Guiu J, Gomez-Pinedo U, Montero-Escribano P, Gomez-Iglesias P, Porta-Etessam J, Matías-Guiu JA. ¿Es esperable que haya cuadros neurológicos por la pandemia por SARS-CoV-2? *Neurología*. 2020;35:170–5, <http://dx.doi.org/10.1016/j.nrl.2020.03.002>.
3. Zhao H, Shen D, Zhou H, Liu J, Chen S. Guillain-Barré syndrome associated with SARS-CoV-2 infection: causality or coincidence? *Lancet Neurol*. 2020;19:383–4, [http://dx.doi.org/10.1016/S1474-4422\(20\)30109-5](http://dx.doi.org/10.1016/S1474-4422(20)30109-5).

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Neurology during the pandemic. Is COVID-19 changing the organisation of neurology departments? ☆



Neurología ante la pandemia. ¿Está el COVID-19 cambiando la organización de los servicios de neurología?

Dear Editor:

Since late 2019, and especially during 2020, multiple cases of COVID-19 have been detected in the Chinese city of Wuhan^{1,2}; the disease has become a pandemic particularly affecting China, Southern Europe, and the USA, with very few places in the world escaping its impact.

Spain is one of the countries hardest hit by the COVID-19 pandemic, although geographical differences can be observed. As of 16 April 2020, there are 182 816 confirmed cases, 19 130 deaths, and 74 797 recovered cases, and a slight downward trend has been observed in mortality, use of emergency departments, and intensive care unit admission.

The true scale of the pandemic is yet to be determined due to a lack of data on the virus' global impact on the general population.

This situation has led to the declaration of the state of alarm in Spain,³ with the Ministry of Health being granted a predominant role and healthcare responsibilities remaining within the scope of regional governments,⁴ which have had to adapt healthcare services to the pandemic and probably reduce the level of care provision for the more specific pathologies of each specialty.

Current data suggest that SARS-CoV-2 is highly contagious. Among the clinical manifestations of COVID-19 (there appear to be a large number of asymptomatic/oligosymptomatic patients),⁵ the main symptoms include fever, non-productive cough, dyspnoea, pulmonary infiltrates, and lymphocytopenia. The disease particularly affects elderly and immunosuppressed individuals.

The most frequent neurological manifestations include anosmia and dysgeusia, as well as myalgia, fatigue, and headache; only limited data are available on central and peripheral nervous system involvement. Anecdotal reports of these types of symptoms are beginning to appear, and databases are being generated, as we lack data from researchers with more experience, such as Chinese professionals. According to Dr Robert Stevens, "we know almost nothing about the potential interactions between COVID-19 and the nervous system."

Despite the increasing number of anecdotal cases and observational data on neurological symptoms, most COVID-19 patients do not present these symptoms, and while neurological alterations are infrequent, they remain a pos-

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Table 1 Organisation of the neurology and neurophysiology unit at Hospital Universitario Virgen del Rocío.

Healthcare	<ol style="list-style-type: none"> 1. Code stroke/on-call shifts. "Clean" pathway including head CT scan and CT angiography, and chest CT scan. Twenty-four-hour availability of neurology consultant and resident, and a back-up consultant 2. Hospitalisation. COVID-19 beds available. Patients testing positive are admitted to the infectious diseases ward. Rotation of staff to decrease risk of infection 3. Two full-time physicians to treat COVID-19 in collaboration with the infectious disease department 4. One physician for in-hospital interconsultation 5. Outpatient care provided by teleconsultation 6. The neurophysiology department only performs emergency complementary tests in hospitalised patients.
Teaching	<ol style="list-style-type: none"> 1. Third- and fourth-year neurology residents working on wards 2. First- and second-year neurology residents working on-call shifts 3. Clinical sessions conducted by video conference 4. Undergraduate courses taught by video conference
Research	<ol style="list-style-type: none"> 1. Collaboration with the Biomedical Institute of Seville by telecommuting

sibility. In addition to the symptoms mentioned above, impaired consciousness, encephalitis, ataxia, Guillain-Barré syndrome,⁶ acute necrotising encephalitis,⁷ trigeminal neuralgia, involvement of the medullary respiratory centre, myelitis, and an increased number of cerebrovascular complications have been reported in the literature, for example in the Chinese study of 221 patients from Wuhan. This study describes 11 cases of ischaemic stroke, one of cerebral venous sinus thrombosis, and one of cerebral haemorrhage; these complications seem to be more frequent among older patients and those with more severe COVID-19. The growing number of anecdotal cases and data from multi-centre databases will probably soon assist in determining the degree of nervous system involvement in COVID-19.

Considering this unprecedented, emergent situation,⁸ how do neurology departments adapt to respond to the pandemic and continue providing neurological care?⁹ We would like to highlight the experience of the clinical neurology and neurophysiology unit at our centre, Hospital Universitario Virgen del Rocío, Seville (Spain) (Table 1).

COVID-19, which mainly causes respiratory symptoms but can also affect the nervous system, is included in the group of neurosystemic diseases. Our department has a neurosystemic disease unit, which for more than 3 years has provided care to patients with neurological symptoms in the context of complex and emergent diseases. SARS-CoV-2 infection is one of the conditions whose diagnosis and

treatment should involve neurologists to improve patients' prognosis.¹⁰ Therefore, the neurosystemic disease unit participates in interpreting and managing infectious diseases. In the earliest published series,¹¹ at least one-third of patients presented neurological manifestations, even with few or no respiratory symptoms at onset. Neurological symptoms are generally due to infection of the olfactory bulb epithelium, either via retrograde synaptic transmission from nerve terminals, or through the haematogenous route, in which the virus damages the angiotensin-converting enzyme 2 (ACE2) receptor and crosses the blood-brain barrier. However, neurological complications have typically been observed in more severe cases, older patients, and those with other such comorbidities as arterial hypertension, but are not directly attributed to these. Approximately 10% of patients presented stroke due to complications of late prothrombotic state or in association with the ACE2 receptor targeted by SARS-CoV-2, present in the vascular endothelium; encephalopathy associated with the ACE2 receptor present in glial cells and neurons¹²; the effects of a "cytokine storm" resembling that observed in immunological reconstitution inflammatory syndrome; or such muscle symptoms as rhabdomyolysis in tissues especially rich in ACE2 receptors. Secondary neurological complications such as those derived from hypoxaemia also require detailed evaluation. Other betacoronaviruses, such as SARS-CoV, caused primary apnoea due to direct viral infection of the medulla and the pons^{13,14}; SARS-CoV and SARS-CoV-2 share more than 74% of antigenic characteristics. Finally, we should mention that several authors, some working near the origin of the pandemic, have highlighted the need to identify and record neurological symptoms in order to prioritise diagnosis of the affected organ and administer adequate treatment to improve prognosis.

This new, emergent pandemic is a challenge for all, and especially for healthcare professionals and specifically neurologists, and our departments must adapt to offer the best possible care. As has previously occurred with neurological complications caused by HIV infection and other infectious pathologies of the central nervous system, neurologists have assisted in the diagnosis and treatment of these patients. This is and will continue to be our task; in the COVID-19 pandemic, in which the characteristics and magnitude of neurological manifestations are yet to be defined, neurologists play a fundamental role, which emphasises the work of such departments as our neurosystemic disease unit. These enable us to improve health outcomes and expand our knowledge of pathologies that present neurological manifestations despite occurring outside the nervous system; through the work of our unit, we are gaining experience in the management of these diseases. In the near future, neurology departments will probably need to reorganise and establish this type of unit, which through the response to the pandemic will equip us to react early and expand the field of neurology.

References

1. Zhu N, Zhang D, Wang W, Li X, Yang B, Song J, et al. A novel coronavirus from patients with pneumonia in China, 2019. *N Engl J Med.* 2020;382:727–33.

2. Wu F, Zhao S, Yu B, Chen Y-M, Wang W, Song Z-G, et al. A novel coronavirus associated with human respiratory disease in China. *Nature*. 2020;579:265–9.
3. Real Decreto 463/2020, de 14 de marzo, por el que se decreta el estado de alarma para la gestión de crisis sanitaria ocasionada por el COVID-19.
4. Acuerdo de 13 de marzo de 2020, del Consejo de Gobierno, por el que se toma en consideración la Orden de la Consejería de Salud y Familias, por la que se adoptan medidas preventivas en Salud Pública en la Comunidad Autónoma de Andalucía como consecuencia de la situación y evolución del coronavirus (COVID-19) (BOJA extraordinario num 6-Sábado 14 de marzo de 2020).
5. Huan C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with a novel coronavirus in Wuhan, China. *Lancet*. 2020;395:497–506.
6. Zhao H, Shen D, Zhou H, Liv J, Cheng S. Guillain-Barré syndrome associated with SARS-CoV-2 infection: casualty or coincidence. *Lancet Neurol*. 2020;19:383–4, [http://dx.doi.org/10.1016/S1474-4422\(20\)30109-5](http://dx.doi.org/10.1016/S1474-4422(20)30109-5).
7. Poyradji N, Shahin G, Noujaim D, Stones M, Pitel S, Griffith B. COVID-19-associated Acute Hemorrhagic Necrotizing encephalopathy: CT and MRI features. *Radiology*. 2020, <http://dx.doi.org/10.1148/radiol.2020201187>.
8. Terry K. US hospitals facing severe challenges from COVID-19, HHS reports says. *Medscape*. April 6, 2020.
9. Matías-Guiu J, Porta-Etessam J, López-Valdés E, García-Morales I, Guerrero-Solá A, Matías-Guiu JA. La gestión de la asistencia neurológica en tiempos de la pandemia de COVID-19. *Neurología*. 2020, <http://dx.doi.org/10.1016/j.nrl.2020.04.001>.
10. Helms J, Kremer S, Merdji H, Clere-Jehl R, Schenck M, Kummerlen C, et al. Neurological features in severe SARS-CoV-2 infection. *N Engl J Med*. 2020, <http://dx.doi.org/10.1056/NEJMc2008597>.
11. Mao L, Wang M, Chen S, He Q, Chang J, Hong C, et al. Neurological manifestations of hospitalized patients with COVID-19 in Wuhan, China: a retrospective case series study. *medRxiv*. 2020, <http://dx.doi.org/10.1101/2020.02.22.20026500>.
12. Palasca O, Santos A, Stolte C, Gorodkin J, Jensen LJ. TISSUES 2.0: an integrative web resource on mammalian tissue expression. *Database*. 2018. No. bay003.
13. Netland J, Meyerholz DK, Moore S, Cassell M, Perlman S. Severe acute respiratory syndrome coronavirus infection causes neuronal death in the absence of encephalitis in mice transgenic for human ACE2. *J Virol*. 2008;82:7264–75.
14. Li YC, Bai WZ, Hashikawa T. The neuroinvasive potential of SARS-CoV2 may be at least partially responsible for the respiratory failure of COVID-19 patients. *J Med Virol*. 2020, <http://dx.doi.org/10.1002/jmv.25728>.

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Report of a patient with neurological symptoms as the sole manifestation of SARS-CoV-2 infection[☆]



Paciente con clínica neurológica como única manifestación de infección por SARS-CoV-2

Dear Editor:

The typical symptoms associated with SARS-CoV-2 infection have been described extensively in the literature^{1,2}; however, the advance of the epidemic is revealing a broader spectrum of clinical manifestations. While neurological symptoms are common over the course of SARS-CoV-2 infection,³ they have not yet been well defined. We present

the case of a 30-year-old woman with no relevant medical or surgical history who presented neurological symptoms as the sole manifestation of SARS-CoV-2 infection.

The patient consulted due to a sensation of instability and loss of balance of 48 hours' progression. Symptoms were accompanied by nausea and vomiting and significantly worsened when she stood; she was unable to walk unassisted. Three weeks earlier, she had presented anosmia and ageusia, lasting 10 days. She reported no headache, hypoacusia, tinnitus, sensation of fullness in the ear, fever, cough, dyspnoea, or diarrhoea. She had not used any drugs or ototoxic medications, or suffered recent head trauma.

Haemodynamic and respiratory vital signs were normal. Higher cognitive functions were intact. Physical examination revealed persistent, purely horizontal, right-beating nystagmus, which was more pronounced with rightward gaze and accompanied by oscillopsia. The head impulse test could not be evaluated due to the appearance of saccades associated with the nystagmus. The alternate occlusion test revealed no deviation. The patient presented positive Romberg sign, falling backward, and was unable to walk in tandem. No auricular lesions were observed. No other relevant findings were observed in the neurological or physical examination.

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