Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

2. Multi-site Adaptive Trials Using Hydroxychloroquine for COVID-19 (MATCH). ClinicalTrials.gov website. https://clinicaltrials.gov/ct2/show/NCT04370262. Accessed May 3, 2020.
3. Mehta P, McAuley DF, Brown M, Sanchez E, Tattersall RS, Manson JJ; HLH Across Speciality Collaboration, UK. COVID-19: consider cytokine storm syndromes and immunosuppression. *Lancet*. 2020;395(10229):1033-1034.
4. Hahm KB, Kim WH, Lee SI, Kang JK, Park IS. Comparison of immunomodulative effects of the histamine-2 receptor antagonists cimetidine, ranitidine, and famotidine on peripheral blood mononuclear cells in gastric cancer patients. *Scand J Gastroenterol*. 1995;30(3):265-271.
5. Frei R, Ferstl R, Konieczna P, et al. Histamine receptor 2 modifies dendritic cell responses to microbial ligands. *J Allergy Clin Immunol*. 2013;132(1):194-204.
6. Jafarzadeh A, Nemati M, Khorramdelazad H, Hassan ZM. Immunomodulatory properties of cimetidine: Its therapeutic potentials for treatment of immune-related diseases. *Int Immunopharmacol*. 2019;70:156-166.
7. Smolinska S, Groeger D, Perez NR, et al. Histamine receptor 2 is required to suppress innate immune responses to bacterial ligands in patients with inflammatory bowel disease. *Inflamm Bowel Dis*. 2016;22(7):1575-1586.
8. Takagaki K, Osawa S, Horio Y, et al. Cytokine responses of intraepithelial lymphocytes are regulated by histamine H(2) receptor. *J Gastroenterol*. 2009;44(4):285-296.
9. Morichika T, Takahashi HK, Iwagaki H, et al. Histamine inhibits lipopolysaccharide-induced tumor necrosis factor-alpha production in an intercellular adhesion molecule-1- and B7.1-dependent manner. *J Pharmacol Exp Ther*. 2003;304(2):624-633.
10. Bourinbaiar AS, Fruhstorfer EC. The effect of histamine type 2 receptor antagonists on human immunodeficiency virus (HIV) replication: identification of a new class of antiviral agents. *Life Sci*. 1996;59(23):PL365-PL370.
11. Bartlett JA, Berry PS, Bockman KW, et al. A placebo-controlled trial of ranitidine in patients with early human immunodeficiency virus infection. *J Infect Dis*. 1998;177(1):231-234.
12. Gooptu C, Higgins CR, James MP. Treatment of viral warts with cimetidine: an open-label study. *Clin Exp Dermatol*. 2000;25(3):183-185.
13. Kürkçüoğlu N, Alli N. Cimetidine prevents recurrent erythema multiforme major resulting from herpes simplex virus infection. *J Am Acad Dermatol*. 1989;21(4, pt 1):814-815.
14. Goldstein JA. Cimetidine, ranitidine, and Epstein-Barr virus infection. *Ann Intern Med*. 1986;105(1):139.
15. Xie X, Geng S, Liu H, Li C, Yang Y, Wang B. Cimetidine synergizes with praziquantel to enhance the immune response of HBV DNA vaccine via activating cytotoxic CD8(+) T cell. *Hum Vaccin Immunother*. 2014;10(6):1688-1699.
16. Yang N, Tanner JA, Zheng BJ, et al. Bismuth complexes inhibit the SARS coronavirus. *Angew Chem Int Ed Engl*. 2007;46(34):6464-6468.
17. Wang X, Boffito M, Zhang J, et al. Effects of the H2-receptor antagonist famotidine on the pharmacokinetics of atazanavir-ritonavir with or without tenofovir in HIV-infected patients. *AIDS Patient Care STDS*. 2011;25(9):509-515.
18. Eom CS, Jeon CY, Lim JW, Cho EG, Park SM, Lee KS. Use of acid-suppressive drugs and risk of pneumonia: a systematic review and meta-analysis. *CMAJ*. 2011;183(3):310-319.
19. Schoenwald PK, Sprung J, Abdelmalak B, Mraović B, Tetzlaff JE, Gurm HS. Complete atrioventricular block and cardiac arrest following intravenous famotidine administration. *Anesthesiology*. 1999;90(2):623-626.

https://doi.org/10.1016/j.mayocp.2020.05.027

Guillain-Barré Syndrome in a Patient With Evidence of Recent SARS-CoV-2 Infection

To the Editor: A 58-year-old woman presented with rapidly progressive gait difficulty and dysgeusia after recovering from a febrile illness. Two weeks before presentation, she had returned from Florida but reported no contacts with persons who had confirmed or suspected coronavirus disease 2019 (COVID-19). She then developed an 11-day illness characterized by fever, myalgia, and asthenia but no respiratory symptoms (Figure).

Six days after recovery, she noted dysgeusia without anosmia, followed by rapidly progressive bilateral paraparesis, imbalance, and severe lower thoracic pain without radiation. One week later, she was admitted locally because of progression of symptoms and now required a gait aid for ambulation. Results of a computed tomography angiogram of the chest and abdomen were negative for dissection but revealed peripheral predominant opacities (Figure). Laboratory workup revealed a normal complete blood count and mild elevation in alanine aminotransferase at 73 U/L but otherwise normal liver function tests. She had an elevated D-dimer at 690 ng/mL, ferritin 575 µg/L, and sedimentation rate 26 mm/hour. Nasopharyngeal swab for severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was negative by an emergency-use authorized real-time polymerase chain reaction (RT-PCR) test.[1]

Given concern for COVID-19 despite the negative RT-PCR result, the patient was started on a 5-day course of hydroxychloroquine, zinc, and methylprednisolone 40 mg twice daily for 5 days, based on local hospital COVID-19 guidelines at that time. Because of progressive paraparesis and evolving areflexia, the local neurologist suspected Guillain-Barré syndrome (GBS). Cerebrospinal fluid (CSF) analysis revealed a protein of 273 mg/dL and 2 total nucleated cells; results of the meningitis/encephalitis panel were negative. Magnetic resonance imaging of the lumbar spine demonstrated smooth enhancement of the cauda equine roots (Figure). Results of locally performed anti-SARS-CoV-2 IgA and IgG serology (Euroimmun Inc., Lubeck, Germany) were positive. The patient was initiated on plasma exchange and received 1 treatment before transfer to our institution for further care.

Upon admission, cranial nerve examination—including olfaction—was normal. The patient had mild neck flexion weakness (Medical Research Council grade 4/5), mild/moderate (4/5) distal upper, and proximal and distal lower-limb weakness. Modified Erasmus GBS Outcome Score (mEGOS) was 1. Deep-tendon reflexes were absent in the legs and decreased in the upper extremities. Plantar responses were flexor. She had moderately severe length-dependent sensory loss in the feet, predominantly affecting large fiber modalities, and associated ataxic gait requiring 1-person assistance. Results of repeated nasopharyngeal SARS-CoV-2 RT-PCR were negative. Results of a qualitative SARS-CoV-2 IgG ELISA (Euroimmun) were again positive, with a signal to cutoff ratio (index

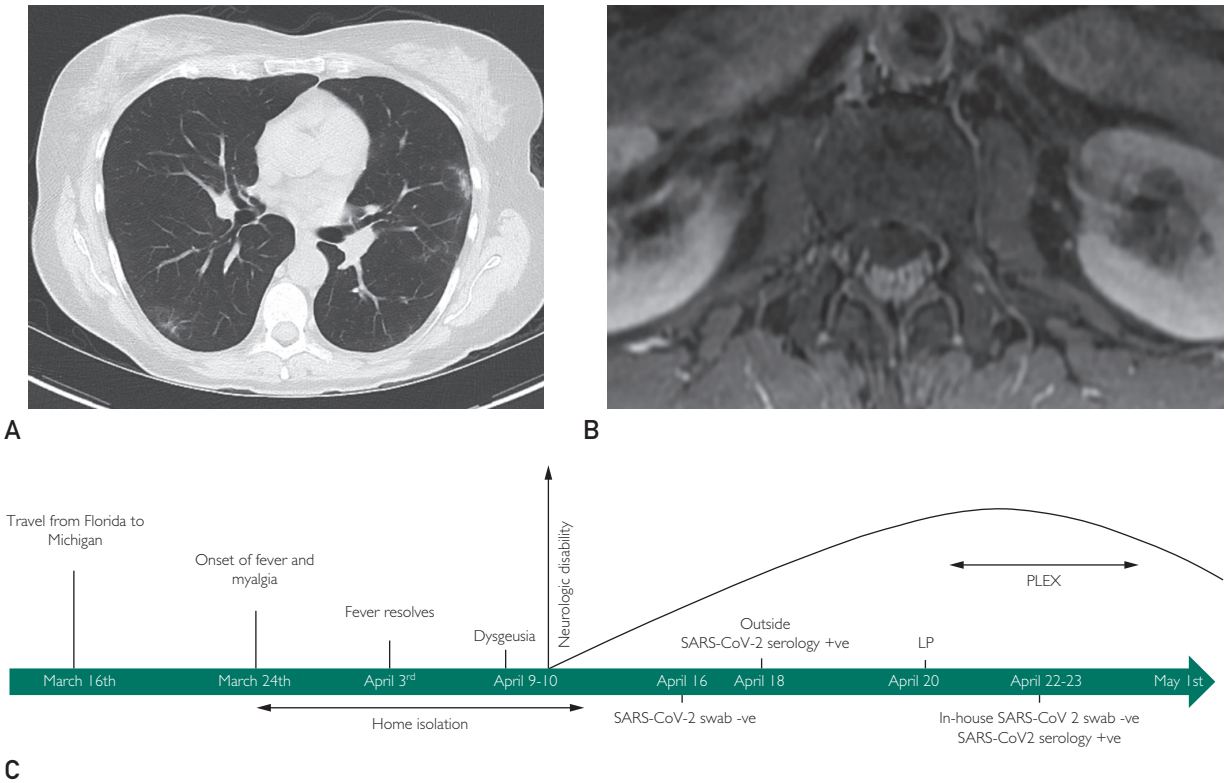

FIGURE. Peripheral predominant opacities on chest CT (**arrows**) (**A**). T1 postgadolinium magnetic resonance images of the lumbar spine demonstrating smooth enhancement of the nerve roots (**arrow**) (**B**). Timeline showing progression of disease (**C**).

value) of 8.2 (normal <0.8). Additional CSF studies included negative oligoclonal bands and IgG index as well as negative SARS-CoV-2 CSF RT-PCR and CSF/serum IgG antibody index results. Electrodiagnostic testing was performed, showing low amplitude and prolonged duration of the upper- and lower-limb compound muscle-action potentials, with prolongation of motor distal latencies, mild slowing of motor conduction velocities, and prolonged F-wave latencies but without conduction block or temporal dispersion on right-sided nerve conduction studies. Needle electromyography showed reduced recruitment of motor unit potentials in distal upper- and lower-limb muscles. These findings supported an acute sensorimotor demyelinating polyradiculoneuropathy, consistent with a diagnosis of GBS. Human immunodeficiency virus, syphilis, West Nile virus, and Lyme disease testing results were negative. Epstein Barr virus, Cytomegalovirus and *Mycoplasma pneumoniae* serology were consistent with remote infection. Ganglioside antibodies were negative as was serum and CSF paraneoplastic evaluation. She completed a total of 5 sessions of every-other-day plasma exchange. By dismissal, her motor and gait examination had improved. Although she remained slightly ataxic, she no longer required a gait aid.

Recently, cases of GBS have been reported in association with SARS-CoV-2 infection in China, Europe, and Iran.[2-9] In several, the onset of neurologic symptoms overlapped with active SARS-CoV-2 infection, suggesting a parainfectious process similar to that reported in association with Zika virus.[10,11] Classic GBS is more commonly postinfectious, with symptoms developing 1 to 3 weeks after infection. This interval presumably permits the generation of antibodies that cross-react by molecular mimicry with specific components of peripheral nerves.[12] The cause of nerve injury in parainfectious cases is less clear, but direct damage from the virus or a hyperacute immune response have been postulated.

Our patient developed neurologic symptoms 17 days after the onset of

fever (Figure). Results of real-time PCR for SARS-CoV-2 on a nasopharyngeal swab were negative, but the test was performed 3 weeks after onset of symptoms, at which point sensitivity is approximately 60% to 70%.[13] Although the results of the CT chest scan were consistent with COVID-19 pneumonia, sputum or bronchoalveolar lavage SARS-CoV-2 RT-PCR was not pursued, given the absence of fever or cough. Overall, the temporal evolution of our patient suggests a postinfectious profile in the setting of probable SARS-CoV-2 infection. The results of the CSF SARS-CoV-2 RT-PCR and IgG antibody index were negative, arguing against neuroinvasion, but neither of these tests has been validated, and sensitivity is unknown. On electrodiagnostic testing, our patient had unequivocal demyelinating features, but both axonal and demyelinating variants have been described in association with SARS-CoV-2.[3,4] Although scarce outcome data are available, our patient's motor examination had substantially improved upon dismissal.

Cases of GBS are increasingly reported in the setting of SARS-CoV-2 infection. Given the ubiquity of the virus, coincident disease is a possibility, although the established association between GBS and infection argues against this proposition. Nonetheless, GBS appears to be relatively rare, based on the limited number of cases reported from countries past the peak of the first wave of the pandemic. It is possible, however, that the association was missed early on in the pandemic, either in critically ill patients who died of the illness or in patients with GBS who were not tested for the virus because of mild or no respiratory symptoms. Ongoing surveillance will be needed to confirm and further elucidate the nature of the association.

Elie Naddaf, MD
Ruple S. Laughlin, MD
Christopher J. Klein, MD
Michel Toledano, MD
Department of Neurology
Mayo Clinic
Rochester, Minnesota

Elitza S. Theel, PhD
Matthew J. Binnicker, PhD
Department of Laboratory Medicine and Pathology
Mayo Clinic
Rochester, Minnesota

Vijayalakshmi Nagappan, MD
Mahdouh Abdulrazzak, MD
Department of Infectious Diseases
Beaumont Hospital
Dearborn, Michigan

David M. Phelan, MD
Department of Hospital Internal Medicine
Mayo Clinic
Rochester, Minnesota

Potential Competing Interests: The authors report no competing interests.

ORCID
Elie Naddaf: https://orcid.org/0000-0001-6212-1236; Ruple S. Laughlin: https://orcid.org/0000-0002-1884-5824; Christopher J. Klein: https://orcid.org/0000-0002-4012-8856; Michel Toledano: https://orcid.org/0000-0002-9046-7880

1. Rodino KG, Espy MJ, Buckwalter SP, et al. Evaluation of saline, phosphate buffered saline and minimum essential medium as potential alternatives to viral transport media for SARS-CoV-2 testing. *J Clin Microbiol*. 2020;58(6):e00590-20.
2. 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(5):383-384.
3. Toscano G, Palmerini F, Ravaglia S, et al. Guillain-Barré syndrome associated with SARS-CoV-2. *N Engl J Med*. 2020. https://doi.org/10.1056/NEJMc2009191.
4. Sedaghat Z, Karimi N. Guillain Barre syndrome associated with COVID-19 infection: a case report. *J Clin Neurosci*. 2020;76:233-235.
5. Padroni M, Mastrangelo V, Asioli GM, et al. Guillain-Barré syndrome following COVID-19: new infection, old complication? *J Neurol*. 2020. https://doi.org/10.1007/s00415-020-09849-6.
6. Gutierrez-Ortiz C, Mendez A, Rodrigo-Rey S, et al. Miller Fisher syndrome and polyneuritis cranialis in COVID-19. *Neurology*. 2020. https://doi.org/10.1212/WNL.0000000000009619.
7. Alberti P, Beretta S, Piatti M, et al. Guillain-Barré syndrome related to COVID-19 infection. *Neurol Neuroimmunol Neuroinflamm*. 2020;7(4):e741.
8. El Otmani H, El Moutawakil B, Rafai MA, et al. Covid-19 and Guillain-Barré syndrome: more than a coincidence!. *Rev Neurol (Paris)*. 2020;176(6):518-519.
9. Scheidl E, Canseco DD, Hadji-Naumov A, Bereznai B. Guillain-Barré syndrome during SARS-CoV-2 pandemic: a case report and review of recent literature. *J Peripher Nerv Syst*. 2020. https://doi.org/10.1111/jns12382.
10. Parra B, Lizarazo J, Jimenez-Arango JA, et al. Guillain-Barré syndrome associated with Zika virus infection in Colombia. *N Engl J Med*. 2016;375(16):1513-1523.
11. Cao-Lormeau VM, Blake A, Mons S, et al. Guillain-Barré syndrome outbreak associated with Zika virus infection in French Polynesia: a case-control study. *Lancet*. 2016;387(10027):1531-1539.
12. Wijdicks EF, Klein CJ. Guillain-Barré syndrome. *Mayo Clin Proc*. 2017;92(3):467-479.
13. Sethuraman N, Jeremiah SS, Ryo A. Interpreting diagnostic tests for SARS-CoV-2. *JAMA*. 2020;323(22):2249-2251.

https://doi.org/10.1016/j.mayocp.2020.05.029

Acute Profound Sensorineural Hearing Loss After COVID-19 Pneumonia

To the Editor: We present the case of a 60-year-old previously healthy man who was admitted to the intensive care unit with a confirmed case of coronavirus disease 2019 (COVID-19) pneumonia 3 days after his initial hospitalization and 8 days after the onset of symptoms (fever, cough). The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus was detected in a nasopharyngeal swab and in bronchoalveolar lavage fluid. Reverse transcriptase–polymerase chain reaction did not show any evidence of other concurrent viral infections including influenza, parainfluenza, respiratory syncytial virus, adenovirus, human metapneumovirus, and rhinovirus. An enzyme-linked immunosorbent assay–based antibody test later confirmed the presence of