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## Treatment of neurology patients during the COVID-19 pandemic in Serbia

### Lečenje neuroloških bolesnika tokom pandemije COVID-19 u Srbiji

To the Editor:

In the period of the COVID-19-precipitated state of emergency in Serbia, up until the 30th September 2020, patients with neurological disorders, who required tertiary level of medical care, have been treated at the following centers: for Belgrade - Neurology Clinic of the Military Medical Academy and its outpatient clinic, Special Hospital for Cerebrovascular Diseases “Saint Sava”, and outpatient clinics of the Accident and Emergency Department of the Clinical Center of Serbia; for Vojvodina – Neurology Clinic within the Clinical Center of Vojvodina; and for central and Southern Serbia – Neurology Clinics within the Clinical Centers of Kragujevac and Niš. The Neurology Clinic within the Clinical Center of Niš has been relocated to the Military Hospital Niš for the majority of this period.

Regarding the outpatient appointments for neurology patients in the first five months of the pandemic (Mart to July), only the Outpatient Clinic of the Military Medical Center Novi Beograd had been open to all categories of population (civilian and military). Since the end of August, the Consultant Neurology Clinic within the Military Medical Academy has also admitted patients with neurological disorders. On the other hand, the Outpatient Clinic of the Clinical Center of Serbia has commenced only a reduced level of appointment bookings, starting from the end of May.

In the observed period, the above-mentioned tertiary centers have hospitalized and treated over 3,000 patients with severe neurological conditions outside the COVID system. The staff of these clinics exhibited heroic efforts in order to provide timely and accurate diagnostic assessment and, in particular, differentiate neurological conditions *per se* from neurological complications of COVID-19. Considering that neurological complications of COVID-19 are common, and outcomes of COVID-19 in patients with existing neurological problems are often severe, such level of dedication and effort was critical in order to avoid spreading of COVID-19 within the neurology wards, which would, in turn, dramatically increase morbidity and mortality rates. An

additional strain for neurology units, particularly in Belgrade, came from the fact that neurology wards within other tertiary institutions, such as Clinical Centers “Zemun”, “Dragiša Mišović”, and City Hospital “Zvezdara”, have not participated in the treatment of neurological patients, since they have been transformed into a part of the COVID system. Moreover, the Neurology Clinic within the Clinical Center of Serbia, the institution with the greatest capacity for neurological hospitalizations in the country, redirected patients to the Department of Emergency Neurology of the Clinical Center of Serbia. Together with the strict observation of the intrahospital epidemiological measures, such as increased distancing within patient rooms, the above-mentioned issues further reduced the capacity of the active wards by over 60% in comparison with the period before the pandemic. Despite this, the Specialised Hospital for Cerebrovascular Diseases “Saint Sava” treated the highest number of patients with cerebrovascular stroke and performed the greatest number of hospitalizations amongst all neurology clinics in Serbia.

In order to provide robust and reliable statistical data, a Working Group of the Society of Serbian Neurologists prepared a database of all neurology patients, including the COVID-19 positive ones, treated at outpatient or hospital settings during the COVID-19 pandemic in Serbia. Thereby, data relating to the admittance, severity, treatment, and outcomes of neurology patients at outpatient and hospital institutions are presented in tabular form, illustrating difficulties, complexities, risks, demands, and dangers of medical care for these patients during the COVID-19 pandemic. It has already become clear that apart from the treatment, which needs to be provided for neurological conditions *per se*, determining the COVID-19 status for these patients and the causal relationship between COVID-19 and neurological symptomatology and outcomes has been critical. Furthermore, including the measures for avoiding the infection from spreading to other patients and medical staff has become crucial while maintaining, at the same time, high standards of treatment for COVID-19 patients in neurology wards.

**Table 1**

**Number of outpatient admittances in polyclinics, outpatient accident and emergency centers, and number of hospitalizations in neurological institutions of tertiary level in Serbia, including the COVID-19 positive patients who have been hospitalized or treated as outpatients**

Institution	Outpatient examinations in polyclinic services	Examinations in emergency centers	Hospitalized patients	Number of COVID-19 positive patients O: outpatients H: hospitalized
Special Hospital "Saint Sava", Belgrade		3,500	1,200	O: 0 H: 42
Clinic for Neurology, MMA, Belgrade	Two outpatient clinics of the Military Medical Center in Belgrade and two outpatient clinics at the Special Polyclinic of the MMA (about 5,000 examinations)	8,294	589	O: 21 H: 17
Clinic for Neurology, CC Niš, Niš	Reduced scheduling due to dislocation	6,159	412	O: 55 H: 7
Clinic for Neurology, CCV, Novi Sad	Reduced scheduling due to dislocation	4,500	400	O: 0 H: 11
Clinic for Neurology CC Kragujevac, Kragujevac	Reduced scheduling due to dislocation	3,000	200	O: 0 H: 0

MMA – Military Medical Academy; CC – Clinical Center; CCV – Clinical Center of Vojvodina.

In Table 1, the number of outpatient-treated and hospitalized neurology patients during the COVID-19 pandemic in Serbia (period March-September, 2020) is given, while in Table 2, the frequency and characteristics of neurological disorders in COVID-19 patients are presented.

Neurological manifestations of COVID-19 are not uncommon, and in the studies published so far, they count in one-third to as many as half of the treated patients<sup>1-9</sup>. Symptoms and signs may involve the nervous system at all levels, from the brain to muscles. For now, studies

most often confirm previous results given in the Chinese population, in which about 30% of patients have neurological manifestations of COVID-19. We presented neurological manifestations that we have observed in 153 COVID-19 positive patients treated at neurological clinics. Like in the other presented study, encephalopathy was the most frequent central nervous system manifestation reported<sup>1-6</sup>. Most cases of altered consciousness were secondary to severe hypoxemia and closely related to the severity of the disease<sup>5-9</sup>. We must

**Table 2**

**Frequency and characteristics of neurological disorders in COVID-19 positive patients**

Institution*	Stroke	Neuroinfection of the periphery and central nervous system	Epileptic seizures	Loss of smell and taste	Encephalopathy and psychiatric symptoms	Fatigue and muscle pain
Speicail Hospital "Saint Sava", Belgrade	42/42 (100%)	0	0	6/42 (14.3%)	10/42 (23.8%)	4/42 (9.5%)
Clinic for Neurology, MMA, Belgrade	11/38 (29%)	3/38 (7.9%)	7/38 (18.4%)	5/38 (13.2%)	11/38 (29%)	21/38 (55.3%)
Clinic for Neurology CC Niš	9/62 (14.5%)	7/62 (11.3%)	5/62 (8.1%)	15/62 (24.2%)	12/62 (19.4%)	20/62 (32.3%)
Clinic for Neurology CCV, Novi Sad	5/11 (45.5%)		2/11 (18.2%)	4/11 (36.4%)	4/11 (36.4%)	4/11 (36.4%)

\*For abbreviations see under Table 1.

Certain patients exhibited more than one neurological manifestation.

All values are presented as numbers (percentages).

emphasize the fact that more and more studies report a higher percentage of cerebrovascular events, which were the initial results reported in the study by Mao et al.<sup>1</sup>. A possible explanation could be the fact that in one number of patients, the acute cerebrovascular disease was the first sign of COVID-19. All this indicates that the neurological manifestations, their development, and unpredictable course in COVID-19 have not been fully studied. Literature data highlight the problem of muscle damage and the consequent feeling of weakness and the appearance of myalgias. Although our data indicate that these symptoms occur in more than thirty percent of neurological manifestations, there are not enough data yet to speculate about the pathogenesis of muscular involvement<sup>1-9</sup>.

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#### R E F E R E N C E S

1. Mao L, Jin H, Wang M, Hu Y, Chen S, He Q, et al. Neurologic manifestations of hospitalized patients with coronavirus disease 2019 in Wuhan, China. *JAMA Neurol* 2020; 77(6): 683–90.
2. Correia AO, Feitosa PWG, Moreira JLS, Nogueira SAR, Fonseca RB, Nobre MAP. Neurological manifestations of COVID-19 and other coronaviruses: a systematic review. *Neurol Psychiatry Brain Res* 2020; 37: 27–32.
3. Baj J, Karakula-Juchnowicz H, Teresiński G, Buszewicz G, Ciesielka M, Sitarz E, et al. COVID-19: Specific and Non-Specific Clinical Manifestations and Symptoms: The Current State of Knowledge. *J Clin Med* 2020; 9(6): 1753.
4. Oxley TJ, Mocco J, Majidi S, Kellner CP, Shirah H, Singh IP, et al. Large-vessel stroke as a presenting feature of COVID-19 in the young. *N Engl J Med* 2020; 382(20): e60.
5. Richardson S, Hirsch JS, Narasimhan M, Crawford JM, McGinn T, Davidson KW, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York City area. *JAMA* 2020; 323(20): 2052–9.
6. Baig AM. Neurological manifestations in COVID-19 caused by SARS-CoV-2. *CNS Neurosci Ther* 2020; 26: 499–501.
7. Helms J, Kremer S, Merdji H, Clere-Huq B, Schenck M, Kummerlen C, et al. Neurologic features in severe SARS-CoV-2 infection. *N Engl J Med* 2020; 382(23): 2268–70.
8. 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(3): 383–4.
9. Ye M, Ren Y, Lv T. Encephalitis as a clinical manifestation of COVID-19. *Brain Behav Immun* 2020; 88: 945–6.

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