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Stroke in Patients with Active COVID-19 Infection: Case Series in a Single Center

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Abstract

BACKGROUND/AIMS: It became evident that severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) not only affects the upper and lower respiratory systems but also all organs expressing angiotensin-converting enzyme-2 receptors, including the central and peripheral nervous systems. In this retrospective study, we aimed to evaluate the characteristics of stroke patients with active SARS-CoV-2 infection.

MATERIALS AND METHODS: This retrospective observational study was conducted at a single center, the central state hospital of the North Cyprus, located in Nicosia. We retrospectively analyzed stroke patients who were also diagnosed with SARS-CoV-2 from January 2020 to April 2022. All patients were hospitalized, and a total of 33 patients with laboratory and radiological or clinical confirmation of SARS-CoV-2 infection were included in the study.

RESULTS: Among the 33 patients, 63.6% were men, and the mean age was 68.9 (SD ±16.4). 81.8% had an ischemic stroke, 6.1% had an ischemic stroke and hemorrhagic transformation, and 3.0% had both ischemic and hemorrhagic stroke and subdural hematoma. Transient ischemic symptoms were observed in 9.1% of patients. Of these patients, 30.3% had hypertension, 24.2% had diabetes, 12.1% had hyperlipidemia, 9.1% had coronary heart disease, and 21.2% had a previous stroke as a comorbidity.

CONCLUSION: In our study, patients had risk factors for stroke, and the severity of SARS-CoV-2 infection was correlated with the severity of clinical symptoms of stroke. In addition, lung involvement during infection.

Keywords: COVID 19, stroke, vaccination

INTRODUCTION

After the outbreak of the severe acute respiratory syndrome-coronavirus-2 (SARS-CoV-2) pandemic in December 2019, it became evident that the virus not only affected the upper and lower respiratory systems but also affected all organs expressing angiotensin-converting enzyme-2 receptors, including the central and peripheral nervous systems.[1] Neurological complications, such as Guillain-Barré syndrome, encephalopathy, encephalitis, and stroke, are mostly encountered. As far as we know, respiratory viruses is a potential trigger of stroke,[2,3] yet it has been found that SARS-CoV-2 infection has a greater risk, especially for ischemic stroke.[4] Here, we report the stroke types, comorbidities, lung involvement, and vaccination status of 33 hospitalized patients with stroke diagnosed with SARS-CoV-2.

MATERIALS AND METHODS

This retrospective observational study was performed at a single center, the central state hospital of the North Cyprus, located in Nicosia. We retrospectively analyzed stroke patients who were also diagnosed

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with SARS-CoV-2 from January 2020 to April 2022. All patients were hospitalized. SARS-CoV-2 was confirmed as a positive result on high-throughput sequencing or real-time reverse transcription polymerase chain reaction analysis of throat and nose swap specimens. A total of 33 patients with laboratory and radiological or clinical confirmation of SARS-CoV-2 infection were included in the study. Radiological assessments including a computed tomography (CT) scan, of both chest and brain were performed on all patients, although cranial magnetic resonance imaging (MRI) was performed on patients without pacemakers, prosthetic materials, etc. Medical records, radiological reports of chest and brain CT and cranial MRI, data on age, sex, comorbidities [hypertension, diabetes mellitus, cardiac disease, hyperlipidemia, coronary heart disease (CHD), previous stroke etc.], National Institutes of Health Stroke Scale (NIHSS) Bamford scale, Modified Rankin Scale (mRS), admission to intensive care unit (ICU), oxygen treatment requirement, and vaccination status were collected. This study was approved by the Dr. Burhan Nalbantoğlu State Hopital Ethics Committee (approval number: YTK. 1.01 (Ek 11/2022), date: 25.04.2022). Verbal consent was obtained from all patients or from an accompanying relative.

Statistical Analysis

Categorical variables were presented as percentages, and continuous variables as mean ± standard deviation (SD) or median interquartile range. Comparisons of baseline variables were performed using χ^2 test for categorical variables. A value of $p<0.05$ was considered significant. Statistical analyses were performed using the Statistical Package for Social Sciences software version 29.

RESULTS

A total of 33 hospitalized stroke patients with confirmed SARS-CoV-2 infection were included. Their mean age was 68.9 years (SD ±16.4) the youngest being 31 and the oldest being 93 at the time of stroke. Among the 33 patients, 63.6% (n=21) were men. Among all of the patients, 81.8% (n=27) had an ischemic stroke, 6.1% had an ischemic stroke and hemorrhagic transformation (n=2), and 3.0% had both ischemic and hemorrhagic stroke and subdural hematoma (n=1). Transient ischemic symptoms were observed in 9.1% (n=3) of the patients (Table 1). Of these patients, 30.3% had hypertension, 24.2 % had diabetes, 12.1% had hyperlipidemia, 9.1% had CHD, and 21.2% had a previous stroke as a comorbidity. Stroke severity of each patient is evaluated with NIHSS, the scores are further divided into three subgroups as follows; group 1, with an NIHSS of 0-5, group 2 score of 6-15, and group 3, a score of 16-24. Group 1 involved 63.6% (n=21) of the patients. Chest and brain CT scans were performed on all patients while the MRI was performed only on 78.8% (n=27) as the remaining were either not fit for an MRI scan or had other contraindications. Patients were further divided into subgroups according to their Bamford Scale scores: 24.2% (n=8) had a total anterior circulation stroke, 18.2% (n=6) had partial anterior circulation stroke, 21.2% (n=7) had posterior circulation syndrome, and 15.1% (n=5) had lacunar stroke. The remaining patients either had a transient ischemic attack or a combination of previously mentioned stroke types.

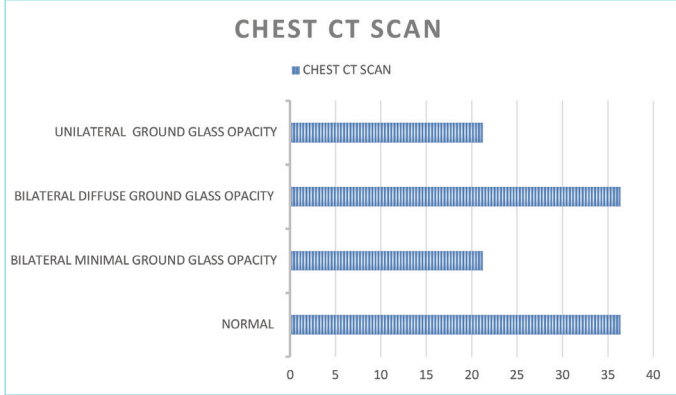
Of all patients, 63.6% (n=21) had thoracal involvement on CT scan. The patients were divided into 3 groups as shown in Graphic 1. 21.2% (n=7) had bilateral minimal ground-glass opacity, whereas 36.4% (n=12) had bilateral diffuse ground-glass opacity. The remaining 21.2% (n=7) only had unilateral involvement on chest CT scan.

As mentioned above, 63.6% of the patients had lung involvement, and 57.6% (n=19) were previously vaccinated. Among the vaccinated, only 36.8% (n=7) needed oxygen treatment and 26.3% (n=5) were admitted to the ICU. Among unvaccinated patients, 57.1% (n=8) required oxygen treatment and were all admitted to the ICU (Graphic 2). Among vaccinated patients, 94.7% (n=18) were discharged from the hospital, there was a 5.3% of exitus while discharge was 71.4% (n=10) and 28.6% of exitus among unvaccinated. A total of 5 patient were discharged as exitus and 4 of them were unvaccinated. These results were obtained using the chi-square test. Among patients with lung involvement, 80% (n=12) were discharged, whereas 88.9% (n=16) among patients who didn't have lung involvement. It has been found that patients with bilateral diffuse lung involvement were all admitted to the ICU; in addition, they had significantly higher mortality rates.

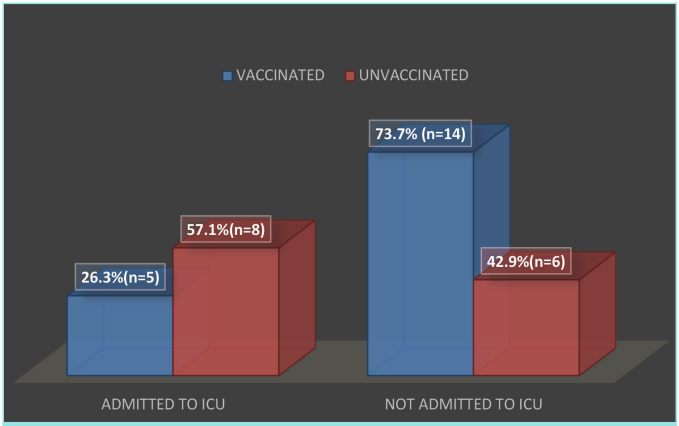
To evaluate disability after stroke, the mRS was used. Patients were divided into 2 subgroups according to their mRS. Group 1 consisted of patients with an mRS of 0-2 and group 2 with mRS 3-6. Only 7.7% (n=1) of patients in group 1 needed ICU, whereas 65% (n=13) in group 2.

Table 1. Demographic characteristics of stroke patients

		Vaccinated	Unvaccinated	Total
Number of patients		19	14	33
Gender	Female	5	7	12
	Male	14	7	21
Age	Mean	63.8 y	75.9 y	
	Median	61 y	76 y	
	Standard deviation	17.2	12.7	
	Minimum age	31 y	50 y	
	Maximum age	92 y	93 y	
Stroke	Ischemic and hemorrhagic transformation	0	2	2
	Ischemic and hemorrhagic transformation and subdural hematoma	1	0	1
	Ischemic	16	11	27
	Transient ischemic attack	2	1	3
	Sum of strokes	**19**	**14**	**33**



Graphic 1. The lung involvement among patients.
CT: Computed tomography



Graphic 2. Vaccination and ICU admission status.
CT: Computed tomography

DISCUSSION

There are reported complications during COVID infection and stroke is one of them.[5] Among several studies, the incidence of ischemic stroke in patients with SARS-CoV-2 was found to be 1.5%, which varied from as low as 0.1% to 6.9% among hospitalized patients.[6] In a recent meta-analysis, patients with severe SARS-CoV-2 infection had a 5-fold increased risk of stroke.[7] Li et al.[8] found in their study that advanced age, severe SARS-CoV-2 infection, a previous history of diabetes, hypertension, or cerebrovascular disease increase the risk of stroke. Another international retrospective study analyzed that patients with COVID-19 and acute ischemic stroke showed increased stroke severity and in addition 51% of patients with COVID-19 and acute ischemic stroke had severe disability at discharge (mRS score 4 vs. 2, $p<0.001$), with increased mortality compared with non-COVID controls.[9] In a recent systematic review including patients with cerebrovascular events in the context of SARS-CoV-2 infection, COVID-19 patients with ischemic stroke had a median NIHSS score of 15, presenting mostly with large vessel occlusion (79.6%), mainly due to either cryptogenic or cardioembolic strokes (44.7% and 21.9%, respectively).[7]

It has been found that there are different mechanisms responsible for stroke. Hypercoagulation, which causes thrombosis, can be responsible for stroke. Trombus formation is also explained by endothelial damage and abnormal blood stasis.[10] During severe infection, a cytokine storm is triggered by inflammation, which causes sepsis and coagulopathy. It has been shown that there are elevated levels of D-dimer and fibrinogen. Zhou et al.[11] and Tang et al.[12] demonstrated increased coagulation markers in their study.

In our study, patients also had risk factors for stroke, and in addition, it has been found that the severity of SARS-CoV-2 infection was correlated with the severity of the clinical symptoms of stroke. In particular, lung involvement during infection affects both mortality and stroke severity. We also found that vaccination status affected the severity of the disease and ICU hospitalization. In our study, all unvaccinated patients were admitted to the ICU, and mortality was higher in unvaccinated patients than in vaccinated patients. Another study found similar results to our study, indicating that patients with acute stroke who were vaccinated had lower NIHSS score at discharge and lower mRS after 3 months. Moreover, they also found that unvaccinated patients had an increased rate of hospitalization for SARS-CoV-2 and a higher mortality rate.[13]

Study Limitations

Although our study has limitations due to the restricted number of patients involved, the findings have been crucial in understanding the association between SARS-CoV-2 infection, vaccination status, and stroke severity.

CONCLUSION

Our study results indicate that SARS-CoV-2 infection particularly the severe form of the disease, has a negative impact on stroke severity.

MAIN POINTS

- Severe SARS-CoV-2 infection and lung involvement has worsened the severity of stroke and in addition the disability score at discharge.
- Although the pathogenesis is complex and risk factors play an important role we have found that co -existing SARS CoV-2 infection increased the duration of hospitalization, and as a result increased the mortality rate of stroke patients.
- According to our study we can also comment that vaccination against SARS CoV-2 has a protective effect particularly to the clinical symptoms of stroke and to admission to the ICU which influences the mortality rate.

ETHICS

Ethics Committee Approval: This study was approved by the Dr. Burhan Nalbantoğlu State Hopital Ethics Committee (approval number: YTK. 1.01 (Ek 11/2022), date: 25.04.2022).

Informed Consent: Verbal consent was obtained from all patients or from an accompanying relative.

Authorship Contributions

Surgical and Medical Practices: B.K., F.S., Concept: B.K., F.S., Design: B.K., F.S., Data Collection and/or Processing: B.K., F.S., S.E.M., Analysis and/or Interpretation: S.E.M., Literature Search: S.E.M., Writing: S.E.M.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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