

The Change in Acute Ischemic Stroke Numbers in the Emergency Service During Early Phase of COVID -19 Pandemic

Abdussamed Vural¹([ID](#)), Iskender Aksoy²([ID](#)), Mehmet Ekiz¹([ID](#))

¹Department of Emergency Medicine, Faculty of Medicine, Giresun University, Giresun, Turkey.

²Clinic of Emergency Medicine, Prof. Dr. A. Ilhan Ozdemir State Hospital, Giresun, Turkey

Received: 07 January 2022, Accepted: 01 February 2022, Published online: 25 February 2022

© Ordu University Institute of Health Sciences, Turkey, 2022

Abstract

Objective: Although the actual relationship between COVID -19 and the incidence of stroke has not yet been clearly defined, various potential mechanisms such as hypercoagulation or viral infecton burden have been reported as risk factors that can increase the risk of stroke. However, various anecdotal reports have emphasized the falling rate of new ischemic stroke diagnoses during period of COVID-19. This study was conducted to estimate the change in the number of new stroke diagnoses and evaluate the approximate causes of such situations during the early period of the COVID-19 outbreak.

Methods: In this retrospective observational descriptive study, the patients were divided into two groups as January-February 2020 (Pre-COVID-19) and March-April 2020 (COVID-19 Period), based on when the first COVID-19 case was reported in Turkey in March 2020. Patients who were admitted to the emergency department (ED) between 01 January 2019 and 30 April 2019 and diagnosed with ischemic cerebrovascular disease were included as the control group to estimate the number of cases predicted for 2020. The data of the groups were retrospectively analyzed in terms of the number of stroke admissions and demographic features.

Results: Among the 274 patients diagnosed with acute ischemic stroke during the 4-month study period, 112 (40.9%) were detected during the COVID-19 period. Considering the linear relationship between the number of patients diagnosed with ischemic stroke in January-February 2019 and March-April 2019 in the control group of the study, this number was expected to be 163 in March-April 2020, since the number of patients with ischemic stroke diagnosed in January-February 2020 was 162. While it was determined that a 25.35% decrease had occurred in January-February 2020 compared to the January-February 2019, it was determined that a 48.9% decrease had occurred in March-April 2020 compared to the same period of the previous year.

Conclusion: This study showed that the number of patients admitted to the hospital with a diagnosis of ischemic stroke in the March-April 2020 decreased statistically significantly compared to the pre-pandemic period of the same year.

Key words: Coronavirus, COVID-19, epidemiology, incidence, ischemic stroke

Suggested Citation Vural A, Aksoy I, Ekiz M. The change in acute ischemic stroke numbers in the emergency service during early phase of COVID -19 pandemic. Mid Blac Sea Journal of Health Science, 2022; 8(1):139-145.

Copyright@ Author(s) - Available online at <https://dergipark.org.tr/en/pub/mbsjohs>

Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.



Address for correspondence/reprints:
Abdussamed Vural

Telephone number: +90 (506) 481 10 70
E-mail: abdussamedvural@gmail.com

INTRODUCTION

Coronavirus 2019 (COVID-19), which causes severe respiratory diseases such as pneumonia and lung failure, was first reported in Wuhan, China in December 2019 (1). On January 7, 2020, the causative agent was identified as a new coronavirus (2019-nCoV) that had not been detected in humans before. A few months after the first report, SARS-CoV-2, which was aptly named due to its similarity to SARS-CoV spread worldwide, reached an epidemic level and was declared as a global health emergency by the World Health Organization (WHO) (2). Clinically, COVID-19 often causes respiratory problems. However, cases involving different systems such as cardiovascular, gastrointestinal, and nervous systems and the skin, have also been reported (3-7).

A stroke is a sudden focal neurological deficit that develops due to impaired blood flow in the corresponding region of the brain (8). Strokes are divided into two groups as hemorrhagic and ischemic, with most of them being ischemic. In an epidemiological study, various risk factors of stroke including diet, obesity, alcohol use, hypercoagulability, infection burden, hormone replacement therapy, physical inactivity, were determined as modifiable risks that depend on lifestyle and environmental factors. On the other hand, age, gender, race and family history of stroke were determined as unmodifiable risk factors (9). Although the true relationship between COVID-19 and the incidence of stroke has not yet been clearly defined, various potential mechanisms such as hypercoagulability (increase in D-dimer level), viral infection load, direct viral infection of the central

nervous system or increased cytokine storm have been reported as risk factors that can increase the risk of stroke (6,10). On the other hand, some studies have emphasized that if modifiable risk factors are controlled, the incidence of stroke will decrease (11-14). Various authors have published the clear message that emerged from the results of the WHO survey regarding the decrease in the number of acute stroke admissions in many countries, including Chile, Colombia, Iran, Greece, England, Belgium and Italy (15). This was shared by global news portals and on scientific blogs (16). Despite previous epidemiological studies reporting that the COVID-19 infection itself is a risk factor for stroke, some anecdotal records and survey results determined a dramatic decrease in the incidence of ischemic stroke during the pandemic.

The aim of this study was to determine whether the incidence of ischemic stroke decreased during the COVID-19 pandemic.

METHODS

Study Design and Settings

Giresun University Training and Research Hospital is the only tertiary care hospital in the province where all acute ischemic stroke cases are diagnosed and treated. The hospital has maintained the hallmark of being the epicenter of diagnosis and treatment regarding acute stroke patients during the pandemic process.

During the study period, only COVID-19 patients did not apply to the hospital where the study was conducted. Non-COVID patients also applied to the hospital. This study was planned retrospectively and approved by the local institutional ethical board (Date: 18.02.2021 / Decision number: 13).

Data Collection

In this retrospective descriptive study, patients who visited the emergency department (ED) of Giresun University Training and Research Hospital between 01 January 2020 and 30 April 2020 and were diagnosed with ischemic stroke by brain diffusion MRI were included. The patients were divided into two groups as January-February 2020 (Pre-COVID-19) and March-April 2020 (COVID-19 Period), based on when the first COVID-19 case was reported in Turkey in March 2020. In order to predict the number of cases predicted for March-April 2020, patients who were admitted to the ED between 01 January 2019 and 30 April 2019 and diagnosed with ischemic cerebrovascular disease were included as the control group. Considering the relationship between the number of patients diagnosed with ischemic stroke in January-February 2019 and March-April 2019 in the control group of the study, the number of expected ischemic stroke cases in March-April 2020 may be estimated according to a change in the number of patients with ischemic stroke diagnosed in January-February 2020. Those under the age of 18, patients who had ischemic cerebrovascular disease while they were hospitalized in any clinical service, cases of ischemic stroke during an outpatient clinic admission, and cases of non-vascular diffusion restriction such as mass were excluded from the study. The demographic characteristics and brain diffusion MRI findings of the patients with ischemic cerebrovascular disease were recorded.

Statistical analysis

The statistical analysis was done using IBM SPSS V23. The Kolmogorov-Smirnov (K-S) test was used to determine whether the quantitative data showed a normal distribution. Mann-Whitney U test was used to compare the two groups in cases where the data did not show normal distribution. The qualitative data were compared using the Pearson Chi-Square test. Descriptive statistics were presented as median (minimum - maximum) and n (%). The statistical significance value was set at $p < 0.05$.

RESULTS

Among the 274 patients diagnosed with acute ischemic stroke in 2020, 112 (40.9%) were detected during the COVID-19 period. When compared to the control group, the number of patients diagnosed with acute ischemic stroke in March-April 2020 was expected to be 163. However, in the COVID -19 period only 112 patients were diagnosed. As a result, it was observed that there were fewer patients in the time interval corresponding to the COVID pandemic in 2020 compared to the same period of the previous year ($p < 0.05$) (Table 1). In addition, the accumulated incidence of patients diagnosed with acute ischemic stroke between January and April 2020 decreased compared to the same periods of the previous year (Figure-1).

Table 1. Comparison of acute ischemic stroke numbers

	2019	2020	p
Jan-Feb*	217 (49.8)	162 (59.1)	0.015
Mar-Apr*	219 (50.2)	112 (40.9)	

* n (%)

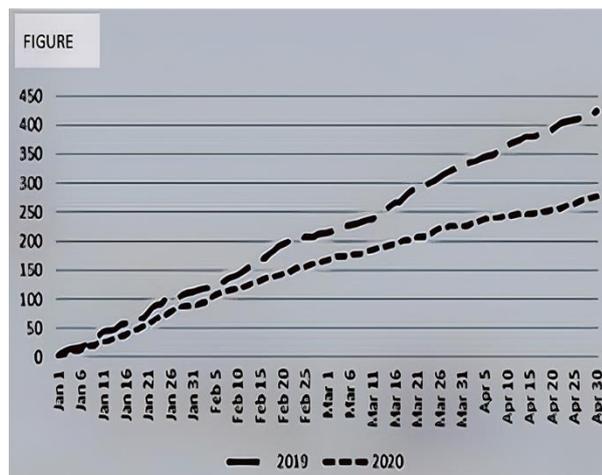


Figure-1. Accumulated incidence of acute ischemic stroke cases in January- April of 2019 and 2020

There was no significant difference in the age and gender distribution of patients diagnosed with ischemic stroke in 2019 or 2020 ($p > 0.05$) (Table 2). In addition to the main result of the study, there was no significant difference in brain diffusion MRI findings before and after the COVID pandemic, compared to March and April 2019. However, right hemisphere involvement and bilateral involvement decreased significantly in the COVID-19 period ($p < 0.05$).

Table 2. Basic characteristics of the patients and the main features of ischemia detected on brain MRI

	Jan-Feb 2019	Mar-Apr 2019	Jan-Feb 2020	Mar-Apr 2020	p***
Age*	80 (23-97)	76 (23-99)	80 (40-98)	78 (35-98)	0.125
Female**	111 (51.2)	109 (49.8)	78 (48.1)	61 (54.5)	0.419
Right Hemisphere**	115 (53)	151 (68.9)	93 (57.4)	63 (56.3)	0.022
Left Hemisphere**	149 (68.7)	126 (57.5)	91 (56.2)	61 (54.5)	0.594
Unilateral**	170 (78.3)	161 (73.5)	140 (86.4)	100 (89.3)	0.001
Bilateral**	47 (21.7)	58 (26.5)	22 (13.6)	12 (10.7)	

* median (min – max), ** n (%), ***comparison between Mar-Apr 2019 and Mar-Apr 2020

DISCUSSION

According to a report published by WHO (17), as of January 5, 2022, there have been over 293 million cases and approximately 5.5 million deaths since the start of the pandemic. Due to the rapid spreading of the pandemic, health systems have been significantly affected. Protective measures have been taken in many countries around the world, including Turkey, to prevent the spread of COVID-19, which has a high human-to-human contagion and infection rate. For example, in Turkey, full-fledged hospitals in provinces around the country have been determined as pandemic hospitals and patients suspected of having COVID-19 have been admitted to such hospitals. The rate of COVID-19 infections in the

community has been tried to be controlled by imposing curfews, practicing social distancing, using of masks and implementing strict hygiene rules. In addition, the green zone admission in emergency services has been terminated, flexible working hours have been implemented and the number of polyclinics has been reduced. Elective surgeries have been delayed, and endovascular treatments have been cut down or stopped in many units.

According to a study in the literature, COVID-19 was reported to be an independent risk factor for ischemic stroke (18). In this regard, ischemic stroke rates that develop secondary to COVID-19 and other infections may have decreased due to controlling the infectiousness during the pandemic period. Some

studies have reported that mild symptoms due to small vessel occlusions cannot be noticed by patients or their relatives during COVID pandemic (19,20). In addition, it is thought that patient admissions to emergency services regarding mild complaints have decreased due to the fear of getting the coronavirus infection and therefore, ischemic stroke diagnoses are made late. In the present study we believe the fact that patients who have had a stroke may be hesitant to call 112 (emergency service call number in Turkey) or go to the hospital for fear of getting COVID-19 infection. So, we also believe that the patients without severe cortical findings (severe aphasia, vision loss, motor loss, etc.) have referred to ED less frequently. However, in a study conducted by Siegler et al., it was reported that the number of patients with large vessel occlusion (LVO) did not significantly change during the COVID-19 period compared to the pre-COVID-19 period. The authors determined a significant increase in the rates of ischemic strokes with large vessel occlusion during the pandemic period (21). In this respect, considering the severity of the disease and cortical findings, it is thought that such a generalization is invalid for ischemic strokes regarding large vessel involvement. Another factor that may contribute to lower stroke rates is the reduction in the use of MRI. However, due to the easy access to MRI within our hospital and the lesser use of it, at least for clinically significant infarctions, we do not believe this. Various studies have reported that the left hemisphere ischemic stroke is more common and often has worse outcomes than the right side (22,23). In our study, it was also determined that the rates of right-sided ischemic stroke detected during the COVID period decreased significantly. This can

be explained by the decrease in the number of admissions regarding ischemic stroke, which causes less explicit symptoms on the right side, especially due to the fear of getting coronavirus infection from hospitals. Additional factors may be contributing for declining in the number of ischemic strokes rate during early phase of the pandemic. Restriction of patient admissions in neurology outpatient clinics may cause insufficient recognition of stroke in the community. Thus, the number of patients with acute ischemic stroke who were referred to the emergency department after being recognized in outpatient clinics may have decreased.

Limitations

This study has some potential limitations that can be a reference for future studies. The study was designed as a single-center retrospective study and included a short period. Prospective, comprehensive, and long-term clinical studies can show the relationship between the COVID-19 pandemic and the incidence of ischemic stroke more clearly. In this respect, the result of the present study has a local effect and could not be generalized. In addition, the study could not show the direct effect of ischemic stroke risk factors during the COVID-19 pandemic periods.

CONCLUSIONS

This study focused on the number of ischemic strokes in the pandemic period. In conclusion in this study, a significant decrease of acute ischemic stroke rates was determined in the first two months of the COVID-19 pandemic compared to the pre-pandemic period of same year. Theoretically, the reduced incidence of stroke suggests that the modifiable risk factors for stroke were under control. However,

comprehensive, and long-term controlled clinical studies are required to prove this relationship. On the other hand, in the present study we believe the fact that patients without severe cortical findings (severe aphasia, vision loss, motor loss, etc.) refer to ED less frequently due to the worry of getting an infection.

Ethics Committee Approval: This study was approved by the Ethical Committee of Giresun University, Giresun Province, Turkey. (Date: 18.02.2021 / Decision number: 13)

Peer-review: Externally peer-reviewed.

Author Contributions: Concept- A.V, I.A, M.E, Design- A.V, I.A, M.E, Materials- A.V, I.A, M.E, Data Collection and/or Processing- A.V, I.A, M.E, Literature Review- A.V, I.A, M.E.

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

Financial Disclosure: The authors declared that this study hasn't received no financial support.

REFERENCES

- Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y. et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet*. 2020;395(10223):497-506.
- Sohrabi C, Alsafi Z, O'Neill N, Khan M, Kerwan A, Al-Jabir A, et al. World Health Organization declares global emergency: A review of the 2019 novel coronavirus (COVID-19). *Int J Surg*. 2020;76:71-6.
- Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. 2020;395(10229):1054-62.
- Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA*. 2020;323(11):1061-9.
- Aubignat M, Godefroy O. COVID-19 and ischemic stroke: Should we systematically look for lupus anticoagulant and antiphospholipid antibodies? *Rev Neurol (Paris)*. 2020;176(6):505-6.
- 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.
- Recalcati S. Cutaneous manifestations in COVID-19: a first perspective. *Journal of the European Academy of Dermatology and Venereology*. 2020;34(5):e212-e213.
- National Institute of Neurological Disorders and stroke. (2020). Stroke Definition. Retrieved from <https://www.ninds.nih.gov/Disorders/All-Disorders/Stroke-Information-Page> Accessed June 1, 2020
- Grysiewicz RA, Thomas K, Pandey DK. Epidemiology of ischemic and hemorrhagic stroke: incidence, prevalence, mortality, and risk factors. *Neurologic clinics*. 2008;26(4):871-95.
- 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):1033-4.
- Steen Krawczyk R, Vinther A, Petersen NC, Faber J, Rehman S, Iversen HK, et al. Self-Reported Physical Activity and Cardiovascular Disease Risk Factors in Patients with Lacunar Stroke. *J Stroke Cerebrovasc Dis*. 2019;28(8):2168-76.

12. Patnode CD, Evans CV, Senger CA, Redmond N, Lin JS. Behavioral Counseling to Promote a Healthful Diet and Physical Activity for Cardiovascular Disease Prevention in Adults Without Known Cardiovascular Disease Risk Factors: Updated Evidence Report and Systematic Review for the US Preventive Services Task Force. *JAMA*. 2017;318(2):175-193.
13. Desikan A. Outdoor air pollution as a possible modifiable risk factor to reduce mortality in post-stroke population. *Neural regeneration research*. 2017;12(3):351-3.
14. Béjot Y, Reis J, Giroud M, Feigin V. A review of epidemiological research on stroke and dementia and exposure to air pollution. *International journal of stroke*. 2018;13(7):687-95.
15. Markus HS, Brainin M. COVID-19 and stroke-A global World Stroke Organization perspective. *International Journal of Stroke*. 2020;15(4):361-4.
16. Stroke Care and the COVID19 Pandemic Words from our President. <https://www.world-> Accessed June 2 , 2020
17. WHO Coronavirus (COVID-19) Dashboard. <https://covid19.who.int/> Accessed January 6, 2022
18. Belani P, Schefflein J, Kihira S, Rigney B, Delman BN, Mahmoudi K, et al. COVID-19 Is an Independent Risk Factor for Acute Ischemic Stroke. *AJNR Am J Neuroradiol*. 2020;41(8):1361-4.
19. Sharma M, Lioutas VA, Madsen T, Clark J, O'Sullivan J, Elkind MSV, et al. Decline in stroke alerts and hospitalisations during the COVID-19 pandemic. *Stroke Vasc Neurol*. 2020;5(4):403-5.
20. Schirmer CM, Ringer AJ, Arthur AS, Binning MJ, Fox WC, James RF, et al. Delayed presentation of acute ischemic strokes during the COVID-19 crisis. *J Neurointerv Surg*. 2020;12(7):639-42.
21. Siegler JE, Heslin ME, Thau L, Smith A, Jovin TG. Falling stroke rates during COVID-19 pandemic at a comprehensive stroke center. *Journal of Stroke and Cerebrovascular Disease*. 2020;29(8):104953.
22. Hedna VS, Bodhit AN, Ansari S, Falchook AD, Stead L, Heilman KM, Waters MF. Hemispheric differences in ischemic stroke: is left-hemisphere stroke more common? *Journal of Clinical Neurology*. 2013;9(2):97-102.
23. Portegies ML, Selwaness M, Hofman A, Koudstaal PJ, Vernooij MW, Ikram MA. Left-sided strokes are more often recognized than right-sided strokes: the Rotterdam study. *Stroke*. 2015;46(1):252-4