

The Curious Case of the Missing Strokes During the COVID-19 Pandemic

Diana Aguiar de Sousa¹, MD, MSc; Else Charlotte Sandset, MD, PhD; Mitchell S. V. Elkind, MD, MS

Despite worldwide efforts, the incidence of coronavirus disease 2019 (COVID-19) continues to increase. To address this ongoing public health emergency, most countries implemented strict social containment measures and reorganized health care systems. Although these were necessary changes to contain the spread of disease and to deal with a rapidly rising number of severe cases that overwhelmed medical systems, the care of patients with other time-sensitive emergencies, such as stroke, has been impacted. Globally, physicians have noted reduced admissions for stroke.^{1,2} However, high-quality clinical registry data confirming this trend and exploring possible reasons has been lacking.

See related articles, p XXX and p XXX

The results of 2 studies confirming these impressions are published in this issue of *Stroke*. In these articles, colleagues from China³ and Spain⁴ used data from stroke registries to compare the number of admissions during the pandemic surge and the corresponding period in the previous year, confirming a clear reduction in stroke admissions during this early phase of the COVID-19 outbreak. They also compared aspects of stroke care before and during the pandemic.

One study, based on data from a registry including 280 stroke centers throughout China, reported a 40% drop in stroke admissions during the pandemic surge.³ No differences were found in the pattern of changes between hospitals designated for COVID-19 and non-designated hospitals. Notably, the proportion of patients

with stroke undergoing thrombolysis and thrombectomy remained stable, despite a 25% reduction in absolute numbers that is likely to be attributed to the drop in stroke admissions. Unfortunately, although this registry includes a large network of certified stroke hospitals, the possibility that some missing patients with stroke were evaluated outside of these selected centers cannot be excluded.

The second report focuses on the changes noted at a single comprehensive stroke center in Barcelona, Spain, a region that was strongly affected by COVID-19.⁴ In addition to finding a similar reduction in stroke admissions of 23%, the authors found an 18% decrease in the number of prehospital stroke codes, despite a 330% increment in the number of calls to emergency medical services during that period. There was also a fall in the number of stroke admissions without previous notification. Impressively, in-hospital stroke care was maintained at a high level, including prehospital and in-hospital metrics, such as time from symptom onset-to-door, door-to-needle, or door-to-groin puncture; proportion of patients undergoing thrombectomy; and neurological and functional outcomes.

What explains this curious decrease of stroke patients during the pandemic? There are likely several contributing reasons for these missing patients with stroke. First, strict instructions to stay at home and fear of infection in a medical facility may have led patients with milder strokes to remain at home. In Barcelona, however, the median baseline National Institutes of Health Stroke Scale score was lower, albeit not significantly so, in March 2020 compared with March 2019, suggesting that a relative decrease in milder strokes cannot fully

Key Words: Editorials ■ emergencies ■ epidemiology ■ prognosis ■ public health ■ thrombectomy

The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.

Correspondence to: Diana Aguiar de Sousa, MD, MSc, Department of Neurosciences and Mental Health (Neurology), Hospital Santa Maria, University of Lisbon, Av Prof Egas Moniz, 1649-028-Lisbon, Portugal. Email dianasousa@campus.ul.pt

For Sources of Funding and Disclosures, see page xxx.

© 2020 American Heart Association, Inc.

Stroke is available at www.ahajournals.org/journal/str

explain the discrepancy. Second, increased social isolation, especially among the elderly, could have contributed by making detection of stroke onset by family members less likely. This explanation is consistent with the finding that patients with stroke admitted during the pandemic were significantly younger. In addition, this theory is supported by data emerging from several countries suggesting a significant increase in mortality during the pandemic period that is unlikely to be explained by COVID-19 cases alone.⁵ This excess mortality could be explained by undiagnosed COVID-19 but may also reflect mortality due to other critical illnesses, including stroke, that went untreated, particularly among the elderly.

Third, as suggested by the analysis of the emergency calls in Catalonia, the massive increase in requests to emergency medical services may have hindered the correct activation of the Stroke Code and limited the ability for emergency medical services to respond to calls. Patients unaccounted for could have been taken to other centers outside of the usual stroke networks, a possibility that cannot be entirely excluded in either study. Fourth, stroke symptoms could have been misinterpreted or not diagnosed properly in some patients with an acute respiratory infection, introducing misdiagnosis. Finally, stroke incidence itself could have declined due to environmental or behavioral changes taking place during the period of reduced economic activity; lower levels of pollution and less physical or emotional strain at work, for example, may reduce stroke risk.^{6,7} Further research on these possibilities in the setting of the pandemic could lead to relevant discoveries about the mechanisms of stroke.

Taken together, observations from these 2 studies show the ability to provide guideline-concordant stroke care in a pandemic with appropriate support from hospital administration and protected stroke pathways. While this is reassuring, it is concerning that during the COVID-19 pandemic some missing stroke patients who would otherwise have been treated could have died or become disabled due to a failure to seek medical attention, as discussed in these reports. Furthermore, the effect on stroke care and outcomes could be worse when hospital systems are completely overwhelmed, and admitted patients cannot get adequate care. In the Barcelona hospital report, although 60% of hospital beds were allocated to patients with COVID-19, it does not appear that the stroke unit itself was adversely affected.

The results, moreover, also raise questions. First, it is uncertain how generalizable these data are, and whether the impact of COVID-19 on stroke depends on specific local or regional stroke systems of care or other features of health care systems. Second, more data are needed on the types of stroke that are most affected by the pandemic. If the reductions in cases are primarily represented by an absence of minor strokes and transient ischemic attacks, we may expect an influx of stroke patients in the coming months due to lack

of adequate secondary prophylaxis. Third, increasing evidence suggests that COVID-19 may itself lead to coagulopathy and vascular endothelial dysfunction,^{8,9} potentially precipitating ischemic stroke,¹⁰ which makes the drop in stroke admissions even more striking. The potential association of COVID-19 with stroke, though rare, requires further study.

Although it may be premature to conclude that a lack of stroke awareness played a major role in the decrease in hospital admissions, stroke professionals need to continue to educate the public and their patients that, even in a pandemic, stroke remains a disabling and potentially fatal illness. Our stroke teams are ready to provide care, even if they require use of higher levels of protective equipment. It is also crucial to ensure that even in these trying times, stroke care remains a priority for health systems and among hospital administrators. Meanwhile, further evaluation of epidemiological and clinical data can provide valuable insights into these trends that can be used to plan health care during future surges of COVID-19 or other pandemics, thereby preventing the long-term impacts of suboptimal stroke treatment.

ARTICLE INFORMATION



American Stroke Association
A Division of the American Heart Association

Affiliations

Department of Neurosciences and Mental Health (Neurology), Hospital Santa Maria, Lisbon, Portugal (D.A.d.S.). Institute of Anatomy, Faculdade de Medicina, Universidade de Lisboa, Portugal (D.A.d.S.). Stroke Unit, Department of Neurology, University of Oslo, Norway (E.C.S.). The Norwegian Air Ambulance Foundation, Oslo, Norway (E.C.S.). Department of Neurology and Sergievsky Center, Vagelos College of Physicians and Surgeons, and Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY (M.S.V.E.). New York-Presbyterian Hospital/Columbia University Irving Medical Center (M.S.V.E.).

Sources of Funding

None.

Disclosures

Dr Aguiar de Sousa reported nonfinancial support from Boehringer Ingelheim outside of the submitted work. Dr Sandset has received an honorarium from Novartis and Bayer outside the submitted work. Dr Elkind receives research support from the BMS-Pfizer Alliance for Eliquis and Roche outside the submitted work.

REFERENCES

1. Markus HS, Brainin M. COVID-19 and stroke - a global world stroke organization perspective [published online April 29, 2020]. *Int J Stroke*. 2020. doi: 10.1177/1747493020923472
2. Kansagra AP, Goyal MS, Hamilton S, Albers GW. Collateral effect of Covid-19 on stroke evaluation in the United States [published online May 8, 2020]. *N Engl J Med*. 2020. doi: 10.1056/NEJMc2014816
3. Zhao J, Li H, Kung D, Fisher M, Shen Y, Liu R. The impact of the COVID-19 epidemic on stroke care and potential solutions. *Stroke*. 2020;51:XXX-XXX. doi: 10.1161/STROKEAHA.120.030225
4. Rudilosso S, Laredo C, Vera V, Vargas M, Renú A, Llull L, Obach V, Amaro S, Urta X, Torres F, et al. Acute stroke care is at risk in the era of COVID-19: experience at a comprehensive stroke center in Barcelona. *Stroke*. 2020;51:XXX-XXX. doi: 10.1161/STROKEAHA.120.030329
5. Banerjee A, Pasea L, Harris S, Gonzalez-Izquierdo A, Torralbo A, Shallcross L, Noursadeghi M, Pillay D, Sebire N, Holmes C, et al. Estimating excess 1-year mortality associated with the COVID-19 pandemic according to underlying conditions and age: a population-based cohort study [May 12, 2020]. *Lancet*. 2020. doi: 10.1016/S0140-6736(20)30854-0

6. Shah AS, Lee KK, McAllister DA, Hunter A, Nair H, Whiteley W, Langrish JP, Newby DE, Mills NL. Short term exposure to air pollution and stroke: systematic review and meta-analysis. *BMJ*. 2015;350:h1295. doi: 10.1136/bmj.h1295
7. Kivimäki M, Jokela M, Nyberg ST, Singh-Manoux A, Fransson EI, Alfredsson L, Bjorner JB, Borritz M, Burr H, Casini A, et al; IPD-Work Consortium. Long working hours and risk of coronary heart disease and stroke: a systematic review and meta-analysis of published and unpublished data for 603,838 individuals. *Lancet*. 2015;386:1739–1746. doi: 10.1016/S0140-6736(15)60295-1
8. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, Xiang J, Wang Y, Song B, Gu X, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*. 2020;395:1054–1062. doi: 10.1016/S0140-6736(20)30566-3
9. Bikkeli B, Madhavan MV, Jimenez D, Chuich T, Dreyfus I, Driggin E, Nigoghossian CD, Agno W, Madjid M, Guo Y, et al. COVID-19 and thrombotic or thromboembolic disease: implications for prevention, antithrombotic therapy, and follow-up. *J Am Coll Cardiol*. 2020; pii:S0735-1097(20)35008-7.
10. Oxley TJ, Mocco J, Majidi S, Kellner CP, Shoirah H, Singh IP, De Leacy RA, Shigematsu T, Ladner TR, Yaeger KA, et al. Large-vessel stroke as a presenting feature of Covid-19 in the young. *N Engl J Med*. 2020;382:e60. doi: 10.1056/NEJMc2009787



Stroke