COVID-19 Impact as an Illustration of Big Data Monitoring of Clinical Practice

Bruce C.V. Campbell, MBBS(Hons), BMedSc, PhD

Coronavirus disease 2019 (COVID-19) has impacted stroke care globally via multiple mechanisms. There have been reports of COVID-19 causing stroke, which fortunately appears to be a relatively rare phenomenon. However, the system of care for patients with diseases other than COVID-19 has been disrupted, and patients with stroke are among those affected. Emergency departments have had to introduce additional screening procedures at triage which can delay initial diagnostic imaging. Stroke units have at times been moved or fragmented to accommodate the surge in COVID-19 or suspected patients with COVID-19, threatening the basic provision of stroke unit care.

See related article, p 1682

One of the concerns highlighted by the World Stroke Organization has been patient and family avoidance of presenting to an emergency department leading to treatment delays and potential missed opportunities for reperfusion therapies. Increased social isolation may reduce symptom discovery and recognition, and there may also be fear of exposure to COVID-19 in hospital. This was evident even in countries like Australia, where COVID-19 case numbers remained relatively low throughout the peak of first and second waves. In some systems, ambulance services have been overwhelmed leading to delays in transport of stroke patients to hospital.

Nogueira et al have investigated the impact of COVID-19 on emergency stroke treatment using data from 23223 patients at 97 US hospitals who had computed tomography angiography for suspected stroke processed by the Vizai software. They found a sharp 23% reduction in scan volume during the initial COVID-19 surge in the United States. The proportion of patients with automatically detected large vessel occlusion was unchanged at 10.7% to 11.5%. The number of patients with both mild and severe imaging profiles declined but numbers with mild stroke (non-large vessel occlusion and computed tomography perfusion lesion <70 mL) reduced more than with severe stroke. Although reductions were numerically greater in the states most affected by COVID-19, there was not a clear linear relationship with COVID-19 burden. More detailed analysis of ischemic core volume and perfusion mismatch characteristics did not detect convincing indirect evidence to support the hypothesis of delayed presentation leading to patients presenting with more advanced stages of stroke progression.

Similar results have been reported in a larger sample of US hospitals using data from 231,753 suspected stroke patients at 856 hospitals using RAPID software. A 39% reduction in the number of patients scanned was noted in the pandemic period that did not appear to correlate with the case volume of COVID-19 infections in each hospital’s region. Based on perfusion imaging volumes, the number of patients scanned was reduced across the spectrum of stroke severity, although this was more pronounced in the group with minimal perfusion abnormality: patients with 0 to 15 mL perfusion lesion reduced by 45% (95% CI, 42%–48%) versus >15 mL perfusion lesion reduced by 30% (95% CI, 26%–35%). Emergency department presentations with non-COVID-19 illnesses generally reduce during pandemic surge. These 2 studies support anecdotal observations

Key Words: Editorials ■ angiography ■ ischemic stroke ■ perfusion imaging ■ thrombectomy ■ thrombolysis

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

Correspondence to: Bruce Campbell, MBBS(Hons), BMedSc, PhD, Department of Neurology, Royal Melbourne Hospital, 300 Grattan St, Parkville VIC 3050, Australia.

Email bruce.campbell@mh.org.au

For Sources of Funding and Disclosures, see page 1692.

© 2021 American Heart Association, Inc.

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

Stroke. 2021;52:1691–1692. DOI: 10.1161/STROKEAHA.120.033628 May 2021 1691
that the proportion of suspected stroke patients with mimics and mild stroke have tended to reduce during COVID-19.\textsuperscript{3,4} While mildly affected patients may have a choice to remain at home, it is more difficult to use patient reluctance to present to hospital to explain a reduction in presentations of severely affected patients with large vessel occlusion. Further research is required to establish if there has been a genuine reduction in incidence of large vessel occlusion stroke during the pandemic and, if so, what factors underlie that. Reduced air pollution, changes in exercise, and medication adherence have all been postulated as speculative mechanisms.\textsuperscript{7}

These studies using large routinely and automatically acquired data sources have advantages in allowing almost real-time monitoring of simple measures such as patient volume and surrogates for clinical severity. This is particularly relevant during a period of hospital resource strain when health care workers may be unable to manually collect research data. Compared with these real-time data, traditional administrative data sets often have a time-lag of several weeks to months. However, for both types of big data, careful consideration of the underlying assumptions are required when drawing conclusions. For instance, Nogueira et al\textsuperscript{5} were able to link the Viz.ai data with hospital admission data for 3 of their hospitals and found that the 26.3% reduction in computed tomography angiography volume overestimated the 11% reduction in admission volume. Without linkage to other data sets, there are also no indicators of time to treatment changes that are equally important in determining stroke outcomes. Delays in thrombolysis and thrombectomy have been reported during COVID-19, but not in all regions.\textsuperscript{8} It is possible that the reduction in road traffic during lockdowns may offset other delays under some circumstances.

Increasingly, large databases generated during routine clinical care will be accessible for secondary research purposes. The volume of data provides advantages in generalizability and geographic coverage that may overcome any imprecision in measurement and surrogate outcomes. Electronic data capture in real-time also has major advantages in reducing lag to analysis time. However, in many cases, the findings will be hypothesis generating and require careful validation of assumptions in more granular sources of data.

**REFERENCES**

1. Yaghi S, Ishida K, Torres J, Mac Gromy B, Raz E, Humbert K, Henninger N, Trivedi T, Lillemoe K, Alam S, et al. SARS-CoV-2 and stroke in a New York Healthcare System. *Stroke*. 2020;51:2002–2011. doi: 10.1161/STROKEAHA.120.033628
2. Oxley TJ, Mocco J, Majidi S, Kelner CP, Shoibrah H, Singh JP, De Leacy RA, Shigematsu T, Ladner TR, Yaege 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/NEJMoa2009787
3. World Stroke Organization. Stroke care and the COVID-19 pandemic. Accessed December 1, 2020. https://www.world-stroke.org/news-and-blogs/news/stroke-care-and-the-covid-19-pandemic
4. Stroke Foundation, Australia. Australian Stroke Coalition statement on stroke care during the COVID 19 crisis. Accessed December 1, 2020. https://strokefoundation.org.au/News/2020/04/24/06/49/Australian-Stroke-Coalition-statement-on-Stroke-Care-during-the-COVID-19-crisis
5. Nogueira R, Davies J, Gupta R, Hassan AE, Devlin T, Haussen D, Mohammaden M, Kelner CP, Arthur A, Eljovich L, et al. Epidemiological surveillance of the impact of the COVID-19 pandemic on stroke care using artificial intelligence. *Stroke*. 2020;51:1892–1896. doi: 10.1161/STROKEAHA.120.031960
6. Kansagra AP, Goyal MS, Hamilton S, Albers GW. Collateral effect of Covid-19 on stroke evaluation in the United States. *N Engl J Med*. 2020;383:400–401. doi: 10.1056/NEJMc2014816
7. Aboootalebi S, Aarkier BM, Andalibi MS, Asdaghi N, Aykac O, Azarpazhooh MR, Bahit MC, Barlinn K, Basri H, Shahripour RB, et al. Call to action: SARS-CoV-2 and Cerebrovascular Disease (CAS-CADe). *J Stroke Cerebrovasc Dis*. 2020;29:104938. doi: 10.1016/j.jstrokecerebrovasdis.2020.104938
8. Kerleroux B, Fabacher T, Bricout N, Moise M, Testud B, Bingadassalom S, Ilgeran H, Janot K, Consoli A, Ben Hassen W, et al; SFNR, the ETIS and the JENI-Research Collaborative. Mechanical thrombectomy for acute ischemic stroke amid the COVID-19 outbreak: decreased activity, and increased care delays. *Stroke*. 2020;51:2012–2017. doi: 10.1161/STROKEAHA.120.030373