

Letter: COVID-19 Pandemic—The Bystander Effect on Stroke Care in Michigan

To the Editor:

Morbidity and mortality associated with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection are extremely visible¹; however, the effect of the COVID-19 pandemic on the management of other pathologies requiring complex interventions and critical care resources—the *bystander effect*²—is not well described. This is certainly true of stroke patients whose clinical outcomes are a function of early presentation, timely diagnosis, emergent intervention, and critical care management.³⁻⁵ With the arrival of COVID-19 cases in the month of March in the hotspot of Michigan, we describe the *bystander effect* of the COVID-19 pandemic on ischemic and hemorrhagic stroke.

METHODS

This is a retrospective analysis of deidentified data submitted from 11 Comprehensive Stroke Centers (CSCs) and 1 Primary Stroke Center (PSC) in Michigan and northwest Ohio. The study was approved by the University Institutional Review Board. Patient consent was not required given the retrospective nature of the study. Using Poisson regression analysis, we calculated the incidence-rate ratios (IRRs) comparing the study period of March 2020 to each of the control periods (February 2020 and March 2019). Additionally, the unpaired *t*-test for continuous variables and the Chi-square test for categorical variables were used as appropriate.

RESULTS

Ischemic Stroke

The study included 1760 ischemic strokes: 518 cases in March 2020 (incidence rate: 16.71), 610 in the February 2020 control group (incidence rate: 21.03), and 632 in the March 2019 control group (incidence rate: 20.39). The rate of ischemic stroke admissions was significantly lower for March 2020 as compared to February 2020 (IRR: 0.85, 95% CI: 0.76-0.95, $P = .006$) and March 2019 (IRR: 0.82, 95% CI: 0.73-0.92, $P = .001$).

Mechanical Thrombectomy

A total of 215 mechanical thrombectomy procedures were performed in this period, with 49 cases in March 2020 (incidence rate: 1.58), 86 cases in February 2020 (incidence rate: 2.96), and 80 cases in March 2019 (incidence rate: 2.58). The rate of mechanical thrombectomy procedures was significantly lower for March 2020 as compared to February 2020 (IRR: 0.57, 95% CI: 0.40-0.81, $P = .002$) and March 2019 (IRR: 0.61, 95% CI: 0.43-0.88, $P = .007$).

There were no significant changes in baseline characteristics, particularly no significant difference in the time from onset to

presentation ($P = .76$) or time from arrival to deployment of the thrombectomy device ($P = .52$), between the March 2020 and February 2020 controls.

Similarly, no significant changes in post-thrombectomy outcomes were detected when comparing the COVID-19 period to control periods (modified Rankin Scale [mRS] score at discharge, $P = .45$; mean length of hospital stay, $P = .1$; complication rate, $P = .63$; discharge location, $P = .48$).

Intravenous Thrombolysis

A total of 210 ischemic stroke patients received tissue plasminogen activator (t-PA), including 66 cases in March 2020 (incidence rate: 2.13), 74 cases in February 2020 (incidence rate: 2.55), and 70 cases in March 2019 (incidence rate: 2.26). There was no significant difference in the administration of t-PA between the study time period and controls.

Nontraumatic Intracerebral Hemorrhage (ICH)

A total of 187 patients were admitted with ICH, including 55 cases in March 2020 (incidence rate: 1.77), 42 cases in February 2020 (incidence rate: 1.44), and 90 cases in March 2019 (incidence rate: 2.90). The rate of ICH admissions was significantly lower in March 2020 as compared to March 2019 (IRR: 0.61, 95% CI: 0.77-0.85, $P = .004$) but was not significantly different from February 2020.

Subarachnoid Hemorrhage (SAH)

A total of 106 patients with aneurysmal SAH were admitted, 34 of whom were evaluated in March 2020 (incidence rate: 1.1), 38 in February 2020 (incidence rate: 1.31), and 34 in March 2019 (incidence rate: 1.1). There were no significant differences in the incidence of SAH between the study time period and the control periods.

Elective Neuro-interventional Cases

There were 284 elective neuro-interventional cases performed in February 2020 (9.8 cases per day) and 184 elective cases performed in March 2020 (5.9 cases per day), representing a significant drop in the number of elective cases performed (IRR: 0.65, 95% CI: 0.54-0.78, $P < .0001$) in the COVID-19 period.

DISCUSSION

As the number of COVID-19 cases in Michigan continued to rise in March, health systems braced for the surge with cancellation of elective cases (35.2% decline from February 2020 to March 2020) while maintaining emergency services. The rate of ischemic stroke admissions was significantly lower for March 2020 as compared to February 2020 (17.8% reduction) (IRR: 0.85, 95% CI: 0.76-0.95; $P = .006$) and March 2019 (IRR: 0.82,

95% CI: 0.73-0.92, $P = .001$). In fact, the rate of mechanical thrombectomy procedures was significantly lower for March 2020 as compared to February 2020 (75.6% reduction) (IRR: 0.57, 95% CI: 0.40-0.81, $P = .002$) and March 2019 (IRR: 0.61, 95% CI: 0.43-0.88, $P = .007$). There were no significant differences in the door-to-device deployment time, mean mRS score at discharge ($P = .66$), or mean length of hospital stay ($P = .39$), between the February 2020 and March 2020 time periods. Of all March thrombectomy cases, only 2 large vessel occlusion (LVO) patients presented with COVID-19 syndrome findings, with a mean age of 67.5 yr and both having M1 occlusions and achieving mRS of 3 and 4. A combination of patient fears, stringent patient transfer criteria, and health system strains may have contributed to lower ischemic stroke admissions as well as the near disappearance of thrombectomy procedures.

SAH patient admissions were not significantly different between March 2020 and March 2019 or February 2020. Nontraumatic ICH admissions were significantly lower in March 2020 when compared to March 2019 but not when compared to February 2020. Hemorrhagic stroke patients are more reliant on hospital admissions for survival, thus overcoming COVID-19 exposure fears or resource strains during the current pandemic. We report of a significant negative bystander effect of the COVID-19 pandemic on ischemic stroke admission and number of thrombectomy procedures performed; however, the effect on hemorrhagic stroke was not as significant.

CONCLUSION

The incidence rate of ischemic stroke admissions and the volume of mechanical thrombectomy procedures decreased significantly during the COVID-19 pandemic. Responses to the current COVID-19 pandemic and future pandemics will need to minimize the *bystander effect* on other critical illnesses reliant on early diagnosis and timely intervention.

Disclosures

The authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

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