

# Acute Stroke Management During the COVID-19 Pandemic

## Does Confinement Impact Eligibility for Endovascular Therapy?

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**ABSTRACT:** During the coronavirus disease 2019 (COVID-19) pandemic, the World Health Organization recommended measures to mitigate the outbreak such as social distancing and confinement. Since these measures have been put in place, anecdotal reports describe a decrease in the number of endovascular therapy (EVT) treatments for acute ischemic stroke due to large vessel occlusion. The purpose of our study was to determine the effect on EVT for patients with acute ischemic stroke during the COVID-19 confinement. In this retrospective, observational study, data were collected from November 1, 2019, to April 15, 2020, at 17 stroke centers in countries where confinement measures have been in place since March 2020 for the COVID-19 pandemic (Switzerland, Italy, France, Spain, Portugal, Germany, Canada, and United States). This study included 1600 patients treated by EVT for acute ischemic stroke. Date of EVT and symptom onset-to-groin puncture time were collected. Mean number of EVTs performed per hospital per 2-week interval and mean stroke onset-to-groin puncture time were calculated before confinement measures and after confinement measures. Distributions (non-normal) between the 2 groups (before COVID-19 confinement versus after COVID-19 confinement) were compared using 2-sample Wilcoxon rank-sum test. The results show a significant decrease in mean number of EVTs performed per hospital per 2-week interval between before COVID-19 confinement (9.0 [95% CI, 7.8–10.1]) and after COVID-19 confinement (6.1 [95% CI, 4.5–7.7]), ( $P<0.001$ ). In addition, there is a significant increase in mean stroke onset-to-groin puncture time ( $P<0.001$ ), between before COVID-19 confinement (300.3 minutes [95% CI, 285.3–315.4]) and after COVID-19 confinement (354.5 minutes [95% CI, 316.2–392.7]). Our preliminary analysis indicates a 32% reduction in EVT procedures and an estimated 54-minute increase in symptom onset-to-groin puncture time after confinement measures for COVID-19 pandemic were put into place.

**Key Words:** COVID-19 ■ goal ■ groin ■ pandemic ■ standard of care

The coronavirus disease 2019 (COVID-19) pandemic is having an enormous impact on the health-care system worldwide directly and indirectly. To mitigate the increasing number of patients with COVID-19, the World Health Organization recommends applying reactive measures to the general public such as stopping all nonessential services, practicing social

distancing, and confining individuals to their homes with the goal of reducing person-to-person contact and, therefore, decreasing viral spread.<sup>1</sup> Stroke due to large vessel occlusion is a neurological emergency and is, fortunately, most oftentimes detected during person-to-person interactions.<sup>2</sup> These interactions facilitate rapid assessment and diagnosis allowing patients to

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## Nonstandard Abbreviations and Acronyms

<b>EVT</b>	endovascular therapy
<b>COVID-19</b>	coronavirus disease 2019

meet the criteria for endovascular therapy (EVT), the standard of care for large vessel occlusion-related patients with stroke.<sup>3</sup> The American Stroke Association, European Stroke Organization, and European Society of Minimally Invasive Neurological Therapy recommend prompt EVT during the current pandemic because of the high mortality rate and severe neurological disability in untreated patients.<sup>4,5</sup> Unfortunately, reports suggest a decrease in the number of EVTs during the pandemic, reportedly a 25.3% decrease in China and a 21% decrease in France compared the number of EVTs performed before the COVID-19 pandemic, which may be explained by patients' ineligibility for EVT due to increased delays from stroke onset to treatment.<sup>6,7</sup>

We sought to determine whether there has been a significant decrease in number of EVTs performed for stroke treatment, in addition to a possible increase in stroke onset-to-groin puncture time. The study design, raw data, statistical analysis, and any related materials are available by request to the first author (Dr Hajdu). The institutional review board at each participating site approved

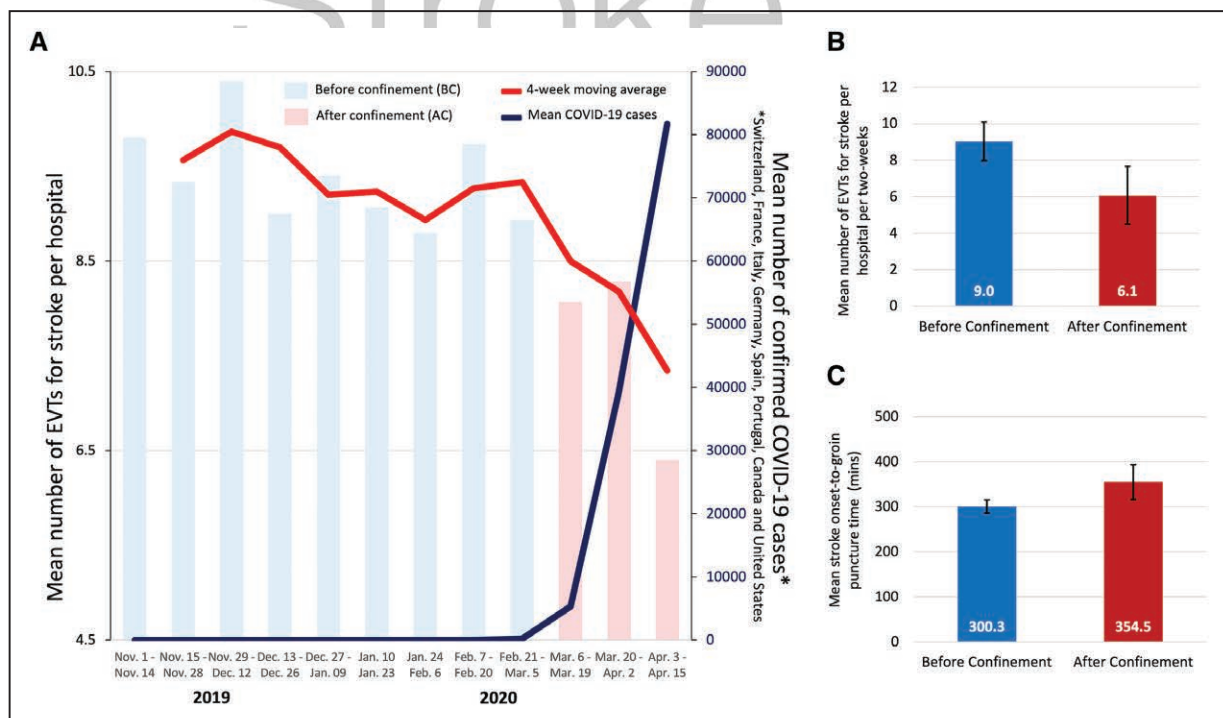
analysis and publication of anonymized and retrospectively obtained data. Informed consent was not required.

We analyzed consecutive EVT procedures performed in 17 stroke centers from November 11, 2019, to April 15, 2020. Among the participating centers, 6 were based in France, 3 in Portugal, 2 in Italy, 2 in Switzerland, 1 in Spain, 1 in Germany, 1 in Canada, and 1 in the United States with an annual mean EVT case load of 187 ([95% CI, 159–215]; min: 96; max: 334).

Among the centers included in this study, 1600 EVT procedures were available for analysis of which 776 had data on stroke onset-to-groin puncture time. Despite the limitation of the latter being available in approximately half of our cohort, we possessed a sufficiently large amount of observations for a robust onset-to-groin puncture time analysis. Official confinement dates were identified for each country varying from March 9, 2020, in Italy to March 23, 2020, in Ontario, Canada. Then based on these dates, 2 periods were established accordingly as before COVID-19 confinement when social life and medical operations were functioning normally and after COVID-19 confinement when government restrictions, social distancing, and confinement were applied.

We calculated (1) mean number of EVTs performed and (2) mean stroke onset-to-groin puncture time interval (minutes) per hospital and per 2-week interval.

For descriptive purpose, we reported mean number of EVTs performed per hospital per 2-week interval, which



**Figure. Endovascular therapy (EVT) for stroke before and after coronavirus disease 2019 (COVID-19) confinement measures.**

**A**, Visual representation of mean number of EVT cases for stroke per hospital per 2-wk period and number of confirmed COVID-19 cases in Switzerland, France, Italy, Germany, Spain, Portugal, Canada, and the United States from November 1, 2019, to April 15, 2020. **B**, Mean number of EVTs for stroke per hospital per 2-wk period and (C) mean stroke onset-to-groin puncture time before and after COVID-19 confinement.

ranged between 6.4 and 10.4 with a 4-week moving average that globally declined with time (Figure [A]). We then compared distributions (non-normal) between the 2 groups (before COVID-19 confinement versus after COVID-19 confinement) using 2-sample Wilcoxon rank-sum tests.

The results showed a significant decrease in mean number of EVT performed per hospital per 2-week interval between before COVID-19 confinement (9.0 [95% CI, 7.8–10.1]) and after COVID-19 confinement (6.1 [95% CI, 4.5–7.7]), ( $P<0.001$ ; Figure [B]). Additionally, we observed a significant increase in mean stroke onset-to-groin puncture time ( $P<0.001$ ), between before COVID-19 confinement (300.3 minutes [95% CI, 285.3–315.4]) and after COVID-19 confinement (354.5 minutes [95% CI, 316.2–392.7]; Figure [C]).

Interestingly, many physicians involved in stroke management would have predicted an increase in the number of acute ischemic strokes and thus EVT due to the known risk of viral-induced hypercoagulable states and reports on cardiovascular complications related to COVID-19.<sup>8</sup> Critically ill patients with COVID-19 have been reported to suffer from a remarkably high rate of thrombotic disease.<sup>9,10</sup> Paradoxically, our analysis shows an estimated 32% reduction in EVT procedures and an estimated 54-minute increase in symptom onset-to-groin puncture time after confinement measures were put into place. This is similar to the data regarding the reduction of emergency cardiac catheterizations in the United States, Spain, and Italy.<sup>11–13</sup> While a more comprehensive report using data from additional stroke centers with corresponding regional analyses is warranted, we hypothesize that decreased person-to-person contact due to social distancing has led to a decrease in stroke admission and thus a drop in EVT, while delayed stroke recognition has led to an increase in prehospital delay time. These effects would lead to an increase in stroke-related morbidity and mortality and, therefore, an unfortunate indirect consequence of the reactive measures promoted by health organizations during the pandemic. While more studies are required to confirm our findings, national health organizations and the World Health Organization should be alerted to this trend and COVID-19 related recommendations in the meantime should consider integrating strategies for medical emergencies such as stroke to avoid irreversible delays in acute stroke management.

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