

**Temporary Emergency Guidance to US Stroke Centers During the COVID-19 Pandemic**  
**On Behalf of the AHA/ASA Stroke Council Leadership**

**Running Title:** Temporary Emergency Guidance to US Stroke Centers

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Stroke

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March 31, 2020

During this unprecedented time of extraordinary stress on the US healthcare system, the AHA/ASA Stroke Council—as individuals in our localities and together as an entity at the national level—acknowledge the mounting concern regarding optimal stroke care during the COVID-19 pandemic among vascular neurologists and those clinicians who care for patients with stroke. We therefore seek to provide guidance for the care of stroke patients in the midst of the crisis. Ordinarily, national recommendations go through a rigorous process of development, refinement, peer review, and thoughtful promulgation. None of that is possible at this time, yet we believe there is a substantial need for a broad policy statement that reflects both the commonality of the pandemic across the US and the individual variability necessary at local sites. We issue this temporary statement as an interim stopgap opinion, pending a more thorough and considered process.

### 1. COVID-19 and Cerebrovascular Disease

Although 80% of patients infected with the virus remain non-hospitalized, in full form, COVID-19 is a severe acute respiratory syndrome caused by a novel coronavirus now named Severe Acute Respiratory Syndrome (SARS) CoV-2<sup>1</sup>. In the past few weeks it has become clear that patients infected with the SARS-CoV-2 virus may present in a number of ways, including with neurological symptoms that are coincident with, or could potentially precede, pulmonary symptoms and fever. To date, no comprehensive survey of neurological manifestations of coronavirus viremia has been published, but two retrospective case series have been posted without peer review on pre-print servers. In these descriptions of convenience samples from three hospitals in Wuhan, China, up to 36% of COVID-19 patients manifest neurological symptoms<sup>2,3</sup>. The most common neurological manifestations were dizziness (16.8%), headache (13.1%), and encephalopathy (2.8%). The most common peripheral signs and symptoms were anosmia (5.1%), dysgeusia (5.6%), and muscle injury (10.1%, detected by elevated creatine kinase). Stroke complicated COVID-19 infection in 5.9% of patients at median 10 days after symptom onset. Patients with stroke were older, had more cardiovascular comorbidities, and more severe pneumonia. Stroke mechanisms may vary and could include hypercoagulability from critical illness and cardioembolism from virus-related cardiac injury<sup>4</sup>. Some of these observations reflect the known biology of the virus, as the obligate receptor for the virus spike protein, human angiotensin converting enzyme, ACE2, is expressed in epithelial cells throughout the body, including in the central nervous system, raising the possibility of a direct role in viral infection<sup>5</sup>. Other coronaviruses, including SARS-CoV-1 and MERS-CoV have been identified in the brains of patients (case reports) and heavily in the brains of mice that express human ACE2<sup>6,7</sup>. However, at this time there are no peer-reviewed published reports of clinical signs of SARS CoV-2 encephalitis or meningitis.

### 2. Exigencies

We seek to describe here the impact of the pandemic on the delivery of acute stroke treatment.

- a. Personal Protective Equipment (PPE). Most immediately, stroke teams may encounter difficulty responding to Code Strokes due to PPE shortages in the Emergency Department (ED) and on inpatient units. In the ED, the Code Stroke patient often arrives with limited available history and few or no family members or witnesses. Many acute stroke patients are confused, aphasic or otherwise unable to provide the necessary information for COVID-19 screening. Ideally, every Code Stroke patient would be treated as potentially infected; the Code Stroke response

team would don full PPE at the highest level. Such an approach is generally not possible, however.

Stroke patients may have asymptomatic SARS-CoV-2 infection or develop COVID-19 after admission and treatment for stroke. Stroke patients frequently develop fevers due to other complications of stroke, such as aspiration pneumonia and UTI, and they will need to be evaluated quickly for COVID-19. These realities will stress the system even further.

Stroke teams across the country have shared with us a variety of creative and novel solutions to the PPE shortage. Prior to sharing these with the stroke community, we feel compelled to vet them and seek permission to publish them. Over the coming days we seek to post helpful solutions and suggestions. For example, some hospitals have partnered with local industry to create PPE with 3D Printers or repurposing of other technology to produce PPE items. We are aware that many teams have begun using telemedicine both within their own ED and regionally. This solution avoids the use of needed PPE, allows a reasonable stroke evaluation, avoids unnecessary inter-facility transfers, and reduces exposure risk for the stroke team.

- b. Hospital Personnel. Either through prophylactic quarantine or direct illness, most stroke teams will be forced to function with fewer staff members. Neurologists and other health care workers may be redeployed to other settings to respond to the increasing demands of COVID-19, particularly as other colleagues become ill. In some centers, ED staff are trained and competent to evaluate Code Strokes, and with stroke team guidance, to administer intravenous thrombolysis or transfer patients for possible mechanical thrombectomy. Some centers have non-stroke team staff available to monitor patients and arrange for post rt-PA or post-thrombectomy care. In other centers, the loss of stroke team members may create a significant gap in care. We are aware of many stroke teams across the country expressing concern as to whether they can or will be able to continue to function.

We believe that all stroke teams should endeavor to adhere to all published guidelines regarding patient selection for therapy; treatment times (e.g., door-to-needle and door-to-groin puncture); and post-recanalization monitoring. However, we wish to inform regulatory authorities—and we wish to reassure stroke teams—that in the setting of the pandemic full compliance has become a goal, not an expectation. Across the wide variety of health care delivery systems in our country, full compliance with all guidelines cannot happen at all times in every locality.

We further wish to distinguish patient selection/treatment from logistic or process compliance. Patients who qualify for treatment will benefit, even if every single vital sign cannot be acquired post thrombolysis, for example. Teams must use their judgement, guided by local realities, and continue to try to treat as many acute stroke patients as possible.

- c. **Hospital Beds.** Most, if not all, medical centers will likely fill all intensive care beds in the setting of COVID-19. Patients with large intracerebral hemorrhages, subarachnoid hemorrhage, or large ischemic strokes at risk for herniation must be monitored in intensive care unit settings with appropriately trained personnel, where possible. We are aware of situations in which NeuroICU beds may be requested for COVID-19 patients, to the exclusion of stroke patients. Although we recognize that hospitals and critical care administrators will need to prioritize ICU resources during the pandemic, we want to encourage appropriate resource allocation for critically ill stroke patients. In each locality specialists from all intensive care specialties—e.g., pulmonary, cardiology, neurology, neurosurgery—must discuss the relative merits of prolonged ICU care for any particular patient.

In the US, stroke patients may be observed in an ICU setting for 24 hours after thrombolysis or thrombectomy, regardless of their status, with rigid intervals for regular vital signs and neurological assessments. There is no evidence base underlying this practice. In the absence of data supporting current practice, we suggest that it is feasible to move stable stroke patients to step-down or other units if an intensive care unit bed is needed<sup>8</sup>.

In general, patients with intracerebral hemorrhage (ICH) and subarachnoid hemorrhage (SAH) have higher mortality and are more likely to undergo an interventional or surgical procedure and require intubation and prolonged time in an intensive care unit, compared to ischemic stroke patients. Physicians and other health care personnel should follow the most up-to-date and evolving guidelines regarding intubation, interventional procedures, and critical care for these patients in setting of the pandemic. Appropriate intensive care of these seriously ill patients with hemorrhagic stroke, some of whom are also young and with an excellent long-term outcome, should be maintained.

Finally, to protect staff, facilitate infectious disease evaluations, and conserve PPE, many hospitals have made the decision to admit all COVID-19 positive patients and those patients still under evaluation, regardless of other co-incident disease, to specialized COVID-19 units. Many of the staff on these units will not have stroke care training. Stroke Medical Directors and Coordinators should provide guidance to staff unfamiliar with managing acute ischemic and hemorrhagic stroke patients.

- d. **Emergency Medical Services (EMS).** We are aware of anecdotal reports that stroke admission volumes have declined in some communities. This observation requires rigorous confirmation before we can offer sensible recommendations. If true, it can be asked whether the public anxiety around COVID-19 discourages some patients, especially those with mild stroke and stroke-mimics, from accessing the EMS. A testable hypothesis would be that in the face of declining total stroke volume there would persist a constant rate of moderate/severe stroke and thrombectomies. We therefore ask all participating stroke centers to contribute their data to the GWTC database vigilantly as this will be the simplest way to document any decrement in stroke volume. We also encourage stroke leaders and advocates to work with local

media and public marketing to encourage patients to continue seeking emergency care if experiencing acute stroke symptoms.

### 3. Provisional Guidance

We can offer very limited guidance to stroke teams in the US at this time. We do pledge to continue to collect your individual protocols and best practices and to evaluate and post them as appropriate. In very broad terms we recommend the following:

- a. Guideline Adherence. Continue treating stroke patients as appropriate. Full adherence to guidelines may be challenging but needed treatment should be offered to the extent possible.  
<https://www.ahajournals.org/doi/pdf/10.1161/STR.0000000000000211>
- b. PPE. Seek ways to minimize the use of scarce PPE in your medical center. Send fewest possible team members to see Code Stroke patients, and into rooms for follow up visits.
- c. Telemedicine. Telemedicine began with telestroke. The NIHSS can be performed efficiently via telemedicine<sup>9</sup>. Televideo is superior to telephone<sup>10</sup>. Yet telephonic consultation is superior to no consult.
- d. Health and Safety. Take care of yourselves, your families, and your teammates. Follow protocol (local, CDC and WHO), including guidelines for hand washing, PPE use, COVID-19 testing and evaluation, and self-quarantine as needed.
- e. Teamwork. Stroke care has always been a multispecialty, collaborative effort among EMS, physicians and nurses from the Emergency Departments to the Stroke Units, ICUs and Rehabilitation Centers. Collaboration, collegiality, and compassion for one another are crucial to making it through this challenge. A true sense of a unified Stroke System of Care is needed now more than ever.



### 4. Caveat

Our recommendations and anecdotal advice are offered to the general stroke community in the context of the gravest public health threat in our country's recent history. Nothing in this document has been submitted to the normal guideline development and peer review, although we will begin such a process immediately and update this statement continuously during the crisis. Please keep checking the AHA/ASA website.

Disclosures: None

## References

1. Lipsitch M, Swerdlow DL, Finelli L. Defining the Epidemiology of Covid-19 — Studies Needed. *New England Journal of Medicine*. 2020;382:1194-1196
2. Mao L, Wang M, Chen S, He Q, Chang J, Hong C, et al. Neurological Manifestations of Hospitalized Patients with COVID-19 in Wuhan, China: a retrospective case series study. *medRxiv*. 2020:2020.2002.2022.20026500
3. Li Y, Wang M, Zhou Y, Chang J, Xian Y, Mao L, et al. Acute Cerebrovascular Disease Following COVID-19: A Single center, Retrospective, Observational Study (3/3/2020). 2020. Available at <http://dx.doi.org/10.2139/ssrn.3550025>
4. Guo T, Fan Y, Chen M, Wu X, Zhang L, He T, et al. Cardiovascular Implications of Fatal Outcomes of Patients With Coronavirus Disease 2019 (COVID-19). *JAMA Cardiology*. 2020. doi:10.1001/jamacardio.2020.1017
5. Li YC, Bai WZ, Hashikawa T. The neuroinvasive potential of SARS-CoV2 may be at least partially responsible for the respiratory failure of COVID-19 patients. *Journal of Medical Virology*. 2020
6. Bao L, Deng W, Huang B, Gao H, Liu J, Ren L, et al. The Pathogenicity of SARS-CoV-2 in hACE2 Transgenic Mice. *bioRxiv*. 2020:2020.2002.2007.939389
7. Arbour N, Day R, Newcombe J, Talbot PJ. Neuroinvasion by Human Respiratory Coronaviruses. *Journal of Virology*. 2000;74:8913-8921
8. Faigle R, Butler J, Carhuapoma JR, Johnson B, Zink EK, Shakes T, et al. Safety Trial of Low-Intensity Monitoring After Thrombolysis: Optimal Post Tpa-Iv Monitoring in Ischemic STroke (OPTIMIST). *The Neurohospitalist*. 2020;10:11-15
9. Alashev AM, Andreev AY, Gonysheva YV, Lagutenko MN, Lutskovich OY, Mamonova AV, et al. A Comparison of Remote and Bedside Assessment of the National Institute of Health Stroke Scale in Acute Stroke Patients. *Eur Neurol*. 2017;77:267-271
10. Meyer BC, Raman R, Hemmen T, Obler R, Zivin JA, Rao R, et al. Efficacy of site-independent telemedicine in the STROKE DOC trial: a randomised, blinded, prospective study. *Lancet Neurol*. 2008;7:787-795