INTERVENTIONAL STROKE MANAGEMENT IN A COVID-19 PATIENT

Kevin Yeboah, MD; Randal Edgell, MD; Joseph Conway, BS; and Amer Alshekhlee, MD, MSc

Kevin Yeboah, St, Louis University, Department of Neurology, St. Louis, MO, USA
Randal Edgell, St. Louis University, Department of Neurology, St. Louis, MO, USA
Joseph Conway, St. Louis University, Department of Neurology, St. Louis, MO, USA
Amer Alshekhlee, SSM Neurosciences Institute and St. Louis University Hospital, St. Louis, MO, USA

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Corresponding author:
Amer Alshekhlee, MD, MSc
Associate Professor of Neurology
SSM Neurosciences Institute and St. Louis University Hospital
Director: SSM DePaul Hospital Stroke Program
12266 DePaul Drive; Suite 100
Bridgeton, MO 63044
Office phone 314-738-2770
amer.alshekhlee@ssmhealth.com
Kevin Yeboah kevin.yeboah@health.slu.edu
Randal Edgell randall.edgell@health.slu.edu
Joseph Conway joseph.conway@health.slu.edu

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Amer Alshekhlee- Reports no disclosures

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Practical implications: In Covid-19 patients, acute stroke management may need to be limited to patients with viable outcomes, perhaps younger population with fewer
comorbidities, and patients without respiratory failure requiring mechanical ventilation. Protecting health care professionals must kept at the forefront if aggressive stroke treatment is employed.
There are now over a million cases of Covid-19 worldwide with thousands of reported
deaths.\(^1\) Based on anecdotal evidence,\(^2\) it has been hypothesized that Covid-19
patients are at risk of thromboembolism causing acute coronary syndromes and
ischemic stroke. Acute treatment outside the designated quarantine units poses a
threat of spreading the illness to health care workers. We report a SARS-CoV-2
positive patient who developed acute ischemic stroke during the hospital course treated
with mechanical thrombectomy. We emphasize the importance of adhering to
institutional protocols to protect health care workers during the interventional
management of acute stroke.

**Case:** A known diabetic and hypertensive 49-year-old woman presented with
progressive shortness of breath, fever, and fatigue. She had mild respiratory distress
requiring oxygen supplementation, was treated in an isolation unit for Covid-19 patients
and received therapy with hydroxychloroquine and azithromycin. She had elevated C-
reactive protein (18.7; reference less than 0.5 milligram per deciliter), lactate
dehydrogenase (386; reference range 125-22 units per liter), procalcitonin (0.21;
reference less than 0.10 nanogram per milliliter), ferritin (3578; reference range 5-204
nanogram per milliliter), and normal prothrombin time (14.2 seconds; reference range
12.1-14.8). On hospital day 2, she developed sudden weakness in the left limbs,
sensory neglect, left hemianopsia and right gaze deviation. The stroke team was
mobilized to the quarantine Covid unit. Adhering to the isolation protocol implemented
by the institution, a N95 face mask was placed on the patient prior to leaving the unit
and all accompanying personnel used personal protective equipment (PPE) including
head and body covers, face masks, goggles, and gloves. Initial NIH Stroke Scale
(NIHSS) was 14 and non-contrast head CT was normal. Alteplase (0.9 milligram per kilogram) was initiated in the imaging suite (69 minutes after symptoms recognition). CT angiography showed a thrombus in the right middle cerebral artery and a filling defect in the left carotid bulb (Figure, A and B). CT perfusion showed a mismatch between cerebral blood volume and mean transit time in the territory of the right middle cerebral artery (Figure, C and D). The decision was made to proceed with mechanical thrombectomy in the interventional radiology suite where standard sterilization procedures were applied. The operating team consisted of 4 persons including one interventionalist, 2 supporting radiology technologists and one registered nurse; all used PPE. Mechanical thrombectomy was successfully completed under conscious sedation through a trans-femoral approach using the standard catheter aspiration with a retrievable stent in the right middle cerebral artery. A diagnostic left carotid angiogram confirmed the presence of a thrombus in the left carotid bulb that was asymptomatic (Figure, G). Resolution of the neurologic symptoms (NIHSS 5) was immediately noticed after (TICI 3; Thrombolysis In Cerebral Infarction) revascularization of the right middle cerebral artery was achieved (Figure, E and F). The patient returned to the quarantine unit where post-intervention neurologic monitoring and physical assessment were performed. On post-operative day 2, the NIHSS dropped to 0 and a post-intervention non-contrast head CT remained normal. Cardiac evaluation including telemetry monitoring and transthoracic echocardiography were normal. Due to the asymptomatic thrombus in the left carotid system, a six month course of oral anticoagulation (apixaban) was commenced. She was discharged to home on hospital day 5 after complete resolution of the respiratory and neurologic symptoms.
Discussion: Coagulopathy and endothelial dysfunction had been proposed in association with Covid-19; however, the exact mechanism is not yet understood. Our patient had several vascular risk factors and she may have had an underlying clotting disorder. The Covid-19 infection may have triggered the clotting cascade resulting in thromboembolism in the bilateral carotid arteries. Based on pathological and laboratory studies, dynamic hypercoagulation as evidenced by microthrombi throughout the blood vessels of multiple organs may be a sequelae of Covid-19 infection. Three Covid-19 patients who developed acute respiratory distress syndrome were treated with intravenous alteplase targeting the microthrombi in the pulmonary microvasculature. Our patient had alteplase administered 69 minutes after the recognition of the stroke symptoms, which is delayed compared to our institutional average of 53 minutes. This delay is attributable to the extra precautions applied throughout the management process. We did not believe alteplase alone would be sufficient in our patient given the extensive thrombosis in the bilateral carotid arteries. Therefore, mechanical thrombectomy was contemplated despite the risk of spreading the illness to the managing team. Reports from Italy suggest that up to 20% of healthcare professionals dealing with positive patients became infected with the virus, in some cases resulting in death. A task force at Stanford University proposed an institutional algorithm based on the patients’ risk profile and the urgency of the needed procedure outside the quarantine unit. Whether to proceed with invasive revascularization procedures in patients with severe Covid-19 infections requiring mechanical ventilation remains an open question. The clinical outcomes in this population have been consistently poor in reported series, even when the patients were functional at baseline.
In extraordinary times, the vigor of reacting to evolving time-critical stroke symptoms must be weighed against the risk of transmitting the virus to health care professionals. This case demonstrates the feasibility of interventional stroke management in Covid-19 positive patients. However, these aggressive treatment options may need to be limited to patients with viable outcomes, perhaps younger population with fewer comorbidities, and patients without respiratory failure requiring mechanical ventilation. Further studies and guidelines are needed in Covid-19 positive patients with acute stroke due to large vessel occlusion.

Appendix 1: Authors

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Contribution</th>
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<tbody>
<tr>
<td>Kevin Yeboah, MD</td>
<td>St. Louis University, St. Louis, MO</td>
<td>Analyzed the data, and drafted the manuscript for intellectual content</td>
</tr>
<tr>
<td>Randal Edgell, MD</td>
<td>St. Louis University, St. Louis, MO</td>
<td>Revised the manuscript for intellectual content</td>
</tr>
<tr>
<td>Joseph Conway, BS</td>
<td>St. Louis University, St. Louis, MO</td>
<td>Analyzed the data and revised the manuscript for intellectual content</td>
</tr>
<tr>
<td>Amer Alshekhlee, MD, MSc</td>
<td>SSM Neurosciences Institute, and St. Louis University, St. Louis, MO</td>
<td>Designed and conceptualized the study, analyzed the data, and drafted the manuscript for intellectual content</td>
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References


**Figure title:** CT angiography and perfusion, and conventional angiography in Covid-19 positive patient.

**Figure legend:** CT angiography showing thrombus and occlusion of the right middle cerebral artery (A) and filling defect in the left carotid bulb (B) suggesting a floating thrombus. CT perfusion showing a mismatch between cerebral blood volume (C) and mean transit time (D) suggesting ischemic penumbra in the territory of the right middle cerebral artery. Conventional angiography of the right common carotid artery (E) showing complete occlusion in the right internal carotid artery followed by complete reperfusion (F) after mechanical thrombectomy. Left carotid angiogram (G) confirms a large floating thrombus in the left carotid bulb.
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