

# COVID-19 meets neurointervention on the pages of *JNIS*

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As 2019 came to a close, a novel B-coronavirus, labeled by the World Health Organization as COVID-19, was noted to be spreading in China.<sup>1</sup> The COVID-19 virus is an enveloped single-strand, positive-sense RNA, which means that the virus can use its RNA as the template from which to create proteins needed for propagation and, ultimately, spread. The name coronavirus refers to the characteristic crown-like appearance of these viruses that is seen on electron microscopy. By spring 2020, COVID-19 was spreading rapidly throughout the United States and Europe, and neurointerventionalists soon found themselves on the frontline.<sup>2</sup> The *Journal of NeuroInterventional Surgery (JNIS)* rapidly became the home for emerging research aimed at promoting the safe management of patients with COVID-19 and concomitant cerebrovascular disease and in understanding the consequences of the pandemic on patients, providers, and stroke care.

COVID-19 was initially described largely in terms of its protean pulmonary manifestations, but it soon became apparent that thrombogenic tendencies elevated the risk of stroke.<sup>3</sup> Understanding how to approach potentially infectious patients became a major focus of a diverse group of articles being submitted to *JNIS*.<sup>4</sup> New York City had a terrible COVID-19 outbreak relatively early in the US experience and were thus positioned to provide helpful observations. For imaging triage, Kihira reported a collective experience of 37.5% of patients with imaging-confirmed stroke having apical lung findings when undergoing CT angiography.<sup>5</sup> Many societies, including the

Society of NeuroInterventional Surgery (SNIS) sought to support their members through expert consensus recommendations.<sup>6</sup> A remarkably personal comment by Dr J Mocco, a *JNIS* editor in the eye of the storm, became one of the most downloaded articles in the recent history of the journal.<sup>7</sup>

Overcoming the challenges of treating patients with emergent cerebrovascular disease during a potentially lethal pandemic was critical to neurointerventionalists, and best practices were shared.<sup>8</sup> As a process and metric-driven field, there were numerous submissions detailing unique experiences and approaches during the pandemic.<sup>9</sup> Several published studies benefited from being part of multicenter longitudinal registries, the largest of which included 1364 patients in the primary analysis.<sup>10</sup> The anesthetic type in mechanical thrombectomy was already a hot topic prior to the pandemic<sup>11</sup>; this debate has increased this past year with Nogueira and colleagues reporting a low conversion rate of 1.6% from monitored anesthesia care to general anesthesia during mechanical thrombectomy among a group of 1919 patients.<sup>12</sup>

Despite efforts by societies like SNIS to reinforce the criticality of patients getting to the hospital when symptoms of emergent large vessel occlusion (ELVO) present, including public service announcements and a novel YouTube video, many centers experienced a curious diminution in the number of patients with ELVO being treated during the pandemic.<sup>13</sup> Even more alarming was the impact on access to mechanical thrombectomy in the African American community. During the COVID-19 pandemic, significantly fewer black patients were treated with thrombectomy than expected based on historical data (24% of 235 patients in February to May 2020 compared with 33% of 1848 patients between January 2017 and February 2020,  $p=0.004$ ).<sup>14</sup> In an associated comment, Regenhardt and colleagues challenged providers to ‘craft more equitable and ethical systems of neurointerventional care

in our communities and around the world.’

Building on a growing body of work by Fargen *et al*, authors surveyed neurointerventionalists to determine the impact of COVID-19 on contemporary practice. Survey respondents reported a nearly complete cessation of elective practice, with 66% reporting increased career stress and 35% increased burnout.<sup>15</sup> While neurointerventionalists were less likely to perform elective cases and perhaps emergent ones, interestingly Lee and colleagues found that physicians were much more productive academically, with eight neuroscience-based journals having a combined average increase of 42.3% original research submissions.<sup>16</sup> Not all research productivity was amplified by the pandemic; Rai studied and reported the impact of COVID-19 on clinical trials and found that ‘widespread disruption of neuroendovascular trials occurred.’<sup>17</sup> The same lead author explored the role that the pandemic might have in promoting remote electronic or phone consent for endovascular stroke trials.<sup>18</sup>

Neurointerventional surgery has always been a technologically driven field. COVID-19 broadened many of our thoughts on what that means. Several groups assessed the feasibility of teleproctoring and its impact on various elements of practice, including clinical trials.<sup>19</sup> Telehealth had been a challenging area historically for a variety of reasons, including reimbursement. The pandemic accelerated trends and Lun *et al* found that virtual clinics were preferred by patients and physicians alike for non-urgent follow-up appointments.<sup>20</sup>

The COVID-19 pandemic continues to change our world in so many ways. Perhaps not surprisingly, neurointerventional care was heavily affected. *JNIS* has taken an active participatory role in informing its readership and has served as a venue for important research, shaping the way we care for patients with cerebrovascular disorders during this challenging time.

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**REFERENCES**

- 1 The WHO-China Joint Mission on Coronavirus Disease 2019, World Health Organization (WHO). Report of the WHO-China joint mission on coronavirus disease 2019 (COVID-19), 2020. Available: <https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf> [Accessed 28 Apr 2021].
- 2 Mahajan A, Hirsch JA. Novel coronavirus: what neuroradiologists as citizens of the world need to know. *AJNR Am J Neuroradiol* 2020;41:552–4.
- 3 Zakeri A, Jadhav AP, Sullenger BA, *et al.* Ischemic stroke in COVID-19-positive patients: an overview of SARS-CoV-2 and thrombotic mechanisms for the neurointerventionalist. *J Neurointerv Surg* 2021;13:202–6.
- 4 Fiorella D, Fargen KM, Leslie-Mazwi TM, *et al.* Neurointervention for emergent large vessel occlusion during the COVID-19 pandemic. *J Neurointerv Surg* 2020;12:537–9.
- 5 Kihira S, Schefflein J, Chung M, *et al.* Incidental COVID-19 related lung apical findings on stroke CTA during the COVID-19 pandemic. *J Neurointerv Surg* 2020;12:669–72.
- 6 Fraser JF, Arthur AS, Chen M, *et al.* Society of NeuroInterventional Surgery recommendations for the care of emergent neurointerventional patients in the setting of COVID-19. *J Neurointerv Surg* 2020;12:539–41.
- 7 Mocco J. Thoughts during a COVID nightmare. *J Neurointerv Surg* 2020;12:637–8.
- 8 Pandey AS, Ringer AJ, Rai AT, *et al.* Minimizing SARS-CoV-2 exposure when performing surgical interventions during the COVID-19 pandemic. *J Neurointerv Surg* 2020;12:643–7.
- 9 Yang B, Wang T, Chen J, *et al.* Impact of the COVID-19 pandemic on the process and outcome of thrombectomy for acute ischemic stroke. *J Neurointerv Surg* 2020;12:664–8.
- 10 Czup AL, Zha AM, Sebaugh J, *et al.* Endovascular thrombectomy time metrics in the era of COVID-19: observations from the Society of Vascular and Interventional Neurology multicenter collaboration. *J Neurointerv Surg* : 2021. doi:10.1136/neurintsurg-2020-017205. [Epub ahead of print: 08 Feb 2021].
- 11 Sørensen LH, Speiser L, Karabegovic S, *et al.* Safety and quality of endovascular therapy under general anesthesia and conscious sedation are comparable: results from the Goliath trial. *J Neurointerv Surg* 2019;11:1070–2.
- 12 Nogueira RG, Mohammaden MH, Moran TP, *et al.* Monitored anesthesia care during mechanical thrombectomy for stroke: need for data-driven and individualized decisions. *J Neurointerv Surg* : 2021. doi:10.1136/neurintsurg-2020-016732. [Epub ahead of print: 21 Jan 2021].
- 13 Schirmer CM, Ringer AJ, Arthur AS, *et al.* Delayed presentation of acute ischemic strokes during the COVID-19 crisis. *J Neurointerv Surg* 2020;12:639–42.
- 14 Al Kasab S, Almallouhi E, Alawieh A. Alarming downtrend in mechanical thrombectomy rates in African American patients during the COVID-19 pandemic-Insights from StAR. *J Neurointerv Surg* 2021;13:304–7.
- 15 Fargen KM, Leslie-Mazwi TM, Klucznik RP, *et al.* The professional and personal impact of the coronavirus pandemic on US neurointerventional practices: a nationwide survey. *J Neurointerv Surg* 2020;12:927–31.
- 16 Lee JE, Mohanty A, Albuquerque FC, *et al.* Trends in academic productivity in the COVID-19 era: analysis of neurosurgical, stroke neurology, and neurointerventional literature. *J Neurointerv Surg* 2020;12:1049–52.
- 17 Rai AT, Leslie-Mazwi TM, Fargen KM, *et al.* Neuroendovascular clinical trials disruptions due to COVID-19. potential future challenges and opportunities. *J Neurointerv Surg* 2020;12:831–5.
- 18 Rai AT, Frei D. A rationale and framework for seeking remote electronic or phone consent approval in endovascular stroke trials - special relevance in the COVID-19 environment and beyond. *J Neurointerv Surg* 2020;12:654–7.
- 19 Orru E, Marosfoi M, Patel NV, *et al.* International teleproctoring in neurointerventional surgery and its potential impact on clinical trials in the era of COVID-19: legal and technical considerations. *J Neurointerv Surg* 2020. doi:10.1136/neurintsurg-2020-017053. [Epub ahead of print: 21 Dec 2020].
- 20 Lun R, Walker G, Daham Z, *et al.* Transition to virtual appointments for interventional neuroradiology due to the COVID-19 pandemic: a survey of satisfaction. *J Neurointerv Surg* 2020;12:1153–6.