Early Lessons From World War COVID
Reinventing Our Stroke Systems of Care

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The global pandemic ignited by SARS-CoV2 (severe acute respiratory syndrome coronavirus 2) infection has shaken the foundations of healthcare delivery across the world. This disruption, however, has been met with a number of inventive approaches in both clinical care and biomedical research. In this special report, we discuss several key innovations in stroke care including telemedicine, mobile stroke units, and virtual health clinics. We highlight their value even after coronavirus disease 2019 (COVID-19) and argue that the time is now to study these approaches rigorously in their expanded use as alternatives to in-person standard of care.

World War COVID

The recent weeks have brought unprecedented challenges across the planet. As healthcare systems address and cope with the COVID-19 pandemic, clinicians and researchers have been asked to reevaluate every aspect of current practice.[1,2] While this moment in time may seem premature to reflect more broadly on the long-term implications of the pandemic, a concerted rethink of our healthcare practices, along with the unique challenges brought by this situation, allows for important insights on how we can improve care delivery for our patients with stroke once the virus has abated.

One way to contextualize our current reality is by drawing comparisons to war. Massive conflicts have historically resulted in major technological breakthroughs because of the need to reduce bureaucracy and accelerate development, but in war these initiatives are implemented to develop weapons. Fortunately, in this war against a global disease, the end result will hopefully be improved therapeutics and better methods for disease evaluation and control.[3] In this special report, we review how in a matter of weeks, if not days, we have revolutionized healthcare delivery and biomedical research at local, national, and international levels. We then argue that the progress we have made and will continue to make to fight World War COVID (WW-COVID) may improve stroke disease control and care after the war. We outline recommendations to obtain the necessary data to demonstrate the efficacy and effectiveness of the infrastructure and technologies that have been rapidly built to better serve our patient populations and improve our systems of care.

Local Changes in Response to WW-COVID

Telemedicine in Emergency Rooms

Telemedicine started as telestroke >20 years ago and as a result of COVID has substantially expanded across the globe. In our hospital system, the telemedicine infrastructure that we have had in place for outlying community hospitals has taken on significantly increased relevance as the primary means of emergency department (ED) acute stroke evaluation, to minimize possible COVID exposures. This approach has been shown by others to be effective at ruling out stroke mimics.[4,5] Expanding this role has considerably improved the ability of local hospitals to retain their patients. Apart from possible endovascular stroke therapy (EST) evaluations, other common reasons for transfer include discomfort with the management of intracerebral hemorrhage. We are finding that nonsurgical patients with intracerebral hemorrhage can be well cared for locally with reliable ED and inpatient telemedicine, although this anecdotal evidence will need substantiation with actual data from rigorously designed trials as discussed below. Possibly, this approach can be used to participate in end-of-life discussions with families, as it has in oncology.[6] By providing inpatient telemedicine consultations at community hospitals, we have been able to help alleviate any uncertainty or anxiety of the local hospitalist by providing vascular neurology expertise and assistance remotely.

Virtual Rounding on Stroke Inpatients

For our local inpatient stroke service, we have switched to a virtual rounding paradigm. This approach has been trialed in several European countries already.[7–9] Residents preround on their own, and the team members convene by video conference. Although we are not advocating this model in peacetime, as it may come at the sacrifice of educational quality and

greater cost, our experience thus far indicates that patient care is not compromised. The number of physical and neurological exams has been reduced in stable patients for whom it would be appropriate to limit patient contact. Communication about patients is through Health Insurance Portability and Accountability Act compliant text messaging services that all members of the team and nursing staff access. In the intensive care unit (ICU), the attending or fellow sees the patients but the residents do not, to minimize the number of exposures. The ICU is divided geographically, to decrease the amount of interaction between ICU nurses and teams. We await multi-center data to better understand the effects of this approach on the quality of patient care. However, for years before COVID, we had developed robust inpatient telemedicine programs at multiple community hospitals. These services have been expanded to assist local hospitalists by providing adequate neurological expertise and assistance remotely.

Virtual Stroke Clinics

The COVID pandemic has obligated practitioners who care for stroke patients in the outpatient setting to quickly convert to telemedicine models of care delivery. Virtual stroke clinics have been set up rapidly with the goal of ensuring continuity of care following hospital discharge and for maintaining secondary and tertiary preventive care for existing stroke patients. Telerehabilitation is also being offered to patients in their homes. Patients are given videos and written materials on self-directed activities to improve limb function, balance, and cognition. This approach could significantly improve our ability to reach patients and reduce loss to follow-up. But before advocating for this change to offsite visits with telemedicine-enabled appointments, data on its efficacy, acceptability, and noninferiority must be gathered.

National and International Changes in Response to WW-COVID

Loosening of Federal Regulations and Billing Changes

At this time during the COVID crisis, many telemedicine companies are providing their equipment at reduced cost or even for free. Federal rules in many countries have been substantially relaxed to facilitate widespread implementation of telemedicine services in all sectors of the healthcare community. Billing codes are now available for various types of telemedicine activities. These changes have already led to wide adoption of telemedicine technologies across the United States and other countries. These changes recapitulate prior eras when countries in the midst of war preparations relied upon industries to generate supplies and weapons at a rapid pace.

International Changes in Response to WW-COVID

As a global health disaster, the pandemic has brought together healthcare professionals through various webinars, web-based conferences, patient registries, and email distribution lists. Rapid communications are occurring among stroke centers in various countries to share information, best practices, and even more importantly, mistakes to avoid to provide the best care possible to our patients with stroke while mitigating the spread of infection. We have learned from the experiences of our colleagues in other countries, particularly from Asia and Europe, who are now at the peak or on the downslope of their curve. International guidelines on stroke care during the pandemic were rapidly published, supplementing existing prior telemedicine guidelines.[10–13] In certain situations, global virtual meetings clearly obviate the need for expensive and environmentally adverse travel.

Early Lessons From WW-COVID

The True Front Line for Emergency Medical Care Is the Prehospital Phase of Care

Emergency medical systems in general have been overwhelmed by COVID-related calls, and yet, except in those places where COVID caseload has exploded, these systems have still been able to care for other emergency conditions. Similarly, stroke units (MSUs) have also been able to continue identifying and treating patients with stroke in the midst of COVID. MSUs are an example of a technology that, if it did not exist before COVID, might have resulted from this war to keep stroke (and presumably other emergency conditions) treatment out of the infected and overburdened ED and by producing better outcomes, reduce hospital length of stay, freeing up hospital beds for those who need it.

The True Cost of Interhospital Transfer Has Become Clear

In the United States, ≈20% of all ED visits for acute ischemic stroke result in an interhospital transfer (≈55 000 patients in 2014).[14] With hospitals already stretched to capacity in many parts of the United States and in other countries, and with predictions of escalating cases in the near future, such transfers are unjustifiable for many situations. One of the most common reasons for interhospital transfer is evaluation for EST. In a series of 199 patients in a well-functioning stroke network in Madrid, 41% of transfers to the comprehensive stroke centers for EST did not result in the patient receiving EST.[15] Another large series in France identified a 45% rate of transfer without resulting in EST.[16] Looking at these so-called futile transfers through the lens of our current reality in the setting of COVID-19, the need to limit or eliminate these occurrences has become exceedingly clear. These are patients who should stay and receive care at local hospitals, and to do so, we must build our systems of care to bring expertise in Vascular Neurology and NeuroImaging to those patients, as discussed below.

Not All Patients With Stroke/Transient Ischemic Attack Need to be Hospitalized, but They Still Need to be Emergently Evaluated and Treated

The number of stroke admissions has declined precipitously at many large hospitals across the United States and in Europe. For example, at the Beth Israel Deaconess Medical Center in Boston, the volume of stroke admissions has decreased by >50% over the past few weeks as compared with a similar time period in 2019. At Memorial Hermann in Houston, a similar decline has also occurred. Smaller hospitals are also

having fewer stroke admissions. The reasons for the decline are not entirely clear, but patients with milder stroke symptoms or transient ischemic attacks (TIAs) are probably avoiding the ED because of the COVID pandemic and the fear of being exposed to the virus in a busy enclosed space with many infected patients. It is uncertain how many such mild stroke patients and TIA patients are avoiding the healthcare system entirely. Avoiding the healthcare system could have dire consequences because the cause of their symptoms will not be identified and an appropriate prevention regimen will be not be implemented. Several possible solutions should be considered. An important first step is for stroke clinicians to implore their institutions to publicize the problem through local media and to strongly encourage patients with stroke or TIA symptoms to seek medical attention. Patients should be encouraged to contact their primary care physicians or go to an urgent care clinic, some of which are not treating COVID patients. Those with more severe symptoms should proceed as soon as possible to an ED after alerting the emergency medical systems. Evaluation in an MSU would be ideal, but unfortunately, they are not widely available. Stroke centers should strongly consider making their expertise available to primary care physicians and urgent care clinics. A call schedule of available stroke specialists can be provided, and the healthcare professional who initially evaluates the patient's symptoms can then contact the on-call stroke specialist to discuss the patient. The stroke specialist can then decide to evaluate the patient remotely by telephone or video, similar to the virtual health clinics that we discuss above. After evaluating the patient, the stroke specialist can decide whether urgent imaging and other tests are needed and how those tests can be obtained. A secondary prevention plan can be initiated. With this paradigm, many mild stroke and TIA patients can avoid hospital admission but still have a reasonable evaluation and treatment plan.

How Do We Ensure That Expanded Services Continue Post–WW-COVID?

Maintaining Reimbursement for TeleNeurology

We need to take advantage of the times to not only ensure that telemedicine services remain where they have been established in the community but also expand these services even further. In most countries, there have been no standard outpatient systems of poststroke care, leaving many patients without access to experts in stroke prevention and recovery following stroke. To maintain newly established infrastructure, billing codes for virtual health should remain after COVID abates, and data need to be acquired now to demonstrate the benefits and return on investment to payors. In other countries with socialized democracies and single payer systems, widespread implementation of telemedicine has a better chance at survival after the pandemic. When hospitals operate under a single system, the benefits will be even more pronounced. The only way to justify these changes, however, is by demonstrating noninferiority against current standard of care.

Expand Remote Enrollments in Clinical Trials

Telemedicine networks have been leveraged for years to enhance enrollment of patients into acute stroke trials. In a similar way, virtual clinic visits can also facilitate enrollment into clinical trials for secondary stroke prevention and recovery.[17–19] Furthermore, televisits of patients in their homes to collect outcome data in clinical trials can decrease patient burden, reduce attrition, and expand enrollment in communities at long distances from the academic medical centers where trials are initiated. All of these approaches using telemedicine overcome barriers to access that physical disability, transportation, and distance may impose. More studies are needed to ensure that various outcome measures obtained remotely are validated and accepted in the clinical and scientific community.

Collect Data and Perform Clinical Trials to Show Noninferiority of Telemedicine and Triage Capability of MSUs

We understand under the present circumstances that governments have expanded emergent use of technologies that are not fully supported yet by randomized clinical trials, and, therefore, the effectiveness of various telemedicine delivery approaches will need to be better studied. But to a certain extent, we are already performing the experiment at this moment; we need to collect data from this current era. Has the care been inferior? Have quality metrics suffered? Have patient outcomes worsened? Can we keep mild stroke/TIA patients at home with telemedicine? Can MSUs serve in that capacity as well, as has been suggested in the past?[20] What is the cost-effectiveness of any of these virtual services against pre-COVID standard of care? These data will be critical for the public to review and for investigators to publish when the crisis abates.

Continue Teamwork and Cooperation to Accelerate Breakthroughs

One of the most amazing and riveting COVID developments is how the conduct of science has rapidly transformed. Despite discouraging in-person social interactions (eg, social distancing, stay at home) across the globe, human society is more organized and collaborative in a unified fight against the virus. Clinical studies for testing of possible therapies and vaccines are proceeding at an accelerated pace. Witnessing what is possible, in peacetime we can do a better job of accelerating the development and testing of new therapies and healthcare delivery models for major public health problems such as stroke-reperfusion, neuroprotection, recovery, or prevention. If the public can rapidly respond to the advice of medical experts to change behavior, we should focus after the crisis on extending our efforts to effect lifestyle changes to prevent stroke. Would we have more therapeutics and advanced health care for cerebrovascular disease in 2020 if we had attacked these problems with the same zeal and spirit of collaboration?

Conclusions

Vascular neurology has been at the vanguard of integrating novel, innovative methods into routine, widespread medical practice.

We have been one of the first medical specialties to incorporate machine learning into everyday clinical practice with imaging software like Viz.ai and RAPID (IschemaView, Stanford, CA), providing real-time clinical decision support, not to mention putting computed tomography scanners on ambulances. The nearly overnight changes we have made and continue to make to address the COVID pandemic have the possibility of rapidly modernizing our approach to many human diseases including stroke. The time to evaluate and accelerate our embrace of these approaches is now. But to justify this transition, we must first design and conduct rigorous trials to capture data on the efficacy and effectiveness of remote and mobile healthcare delivery. Doing so will help our patients not just during this time of a pandemic but by establishing these changes, we can modernize medicine for patients with stroke across the globe.

Disclosures

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