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COMMENTARY

The SARS-CoV-2/COVID-19 pandemic and challenges in stroke care in IndiaP. N. Sylaja,^{1,a} M. V. Padma Srivastava,^{2,a} Sudhir Shah,³ Rohit Bhatia,² Dheeraj Khurana,⁴ Arvind Sharma,⁵ Jeyaraj D. Pandian,⁶ Kiran Kalia,⁷ Deepaneeta Sarmah,⁷ Sruthi S. Nair,¹ Dileep R. Yavagal,⁸ and Pallab Bhattacharya⁷ 

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Stroke care in India has evolved rapidly in the last decade with a focus on stroke awareness, prevention, rapid triage, treatment, and rehabilitation. But acute stroke care and poststroke rehabilitation in the country have limitations owing to the economic constraints and poor access to health care. The SARS-CoV-2/COVID-19 pandemic has made stroke care even more challenging. We outline the unfavorable circumstances in stroke care induced by the pandemic; propose mitigating measures; crisis management; and provide a comparative evaluation of stroke care between India and the United States during the pandemic. There is a need for public health systems in both developed and developing countries to improve awareness, implement proper strategies of triage, acute treatment, well-defined rehabilitation plans, telemedicine services, and virtual check-ins.

Keywords: COVID-19; stroke; management; telemedicine; India; United States; public health; pandemic; SARS-CoV-2

Introduction

Systems of stroke care in India have been evolving at a rapid pace in recent years to meet the stroke burden, with remarkable advances made in stroke awareness, prevention, rapid triage, treatment, and rehabilitation. Yet, acute stroke care and poststroke rehabilitation in the country have limitations owing to the economic constraints and poor access to healthcare, burdening a large section of the population.¹ It is not surprising that the health impact of the SARS-CoV-2/COVID-19 pandemic sweeping the world has created challenges for stroke

care in India, which are distinct from those faced by the developed world.

We conducted a survey of stroke experts from 13 established stroke centers in India using a brief questionnaire aimed at capturing the impact of the COVID-19 pandemic and the nationwide lockdown on acute stroke care services. We compare our data with that from a developed country, the United States of America, and attempt to understand and substantiate the observed similarities and differences. In this report here, we, stroke neurologists from high-volume stroke centers in India, identify the weak links in acute stroke care, poststroke rehabilitation, and care of stroke survivors during the COVID-19 outbreak, and suggest remedial measures with a special focus on telemedicine.

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The SARS-CoV-2 outbreak in India and impact on health care

India is home to 1.37 billion people, nearly one fifth of the world's population.² The first case of COVID-19 in India was reported on January 30, 2020 and rapid escalation of cases was noted in mid-March, with confirmed cases crossing 70,756 as of May 12, 2020. A nationwide lockdown in India was imposed on March 25, 2020, which brought to a standstill nearly all travel and commercial human activities across the country.³ The swift and strict restrictive measures adopted have at least temporarily halted the flooding of the health services with COVID-19 cases, though current epidemiological models project the peak of the curve for hospital admissions to be in June or July 2020.^{3,4}

The stroke "chain of survival" and care pathways in India have likely been affected in one way or the other because of the pandemic and lockdown. The shortfall of health insurance coverage and rehabilitative care centers ensures that most of the burden of illness is borne by out-of-pocket payment by patients and families.⁵ A large percentage of specialized health services, such as advanced stroke care, is provided by corporate hospitals.⁵ However, many of these centers are currently unable to extend care for stroke in persons suspected of having COVID-19, as COVID-19 care in India is mostly confined to designated hospitals under the state and central governments. The few exceptions are in regions with a high COVID-19 caseload, where some of the larger private hospitals have been identified for care. Individuals from poorer sections of society and daily-wage workers are the worst affected owing to their already limited access to a healthcare facility.⁵ The priority has shifted from health to daily sustenance for economically weaker populations. Lower educational levels and traditional cultural beliefs contribute to poor understanding of the need for quarantine and distancing measures.⁶ These factors may eventually lead to a rise in COVID-19-related as well as –nonrelated diseases—including stroke-related mortality and morbidity—across the country in the coming days. An additional concern is the high risk of infection among healthcare workers from the shortage of personal protective equipment (PPE), which can lead to a reduced workforce available for stroke services.

Impact of the SARS-CoV-2/COVID-19 pandemic in acute stroke services in India: survey report

From the data received from apex centers of India (Table 1) through the survey and contacts, it is apparent that the onset of the SARS-CoV-2 pandemic has resulted in significant changes in the number of reported, and treatment of, stroke patients. The questionnaire-based survey was conducted among neurologists in 13 major centers of the country, including eight government/academic institutes and five large private hospitals (Fig. 1A and B). The questionnaire consisted of 11 questions related to the changes noted in acute stroke care following the outbreak of the COVID-19 pandemic. An overall reduction of about 61.22% in the reporting of weekly stroke cases across the country has been observed since the lockdown. Intravenous thrombolysis and endovascular procedures were also severely affected, with an overall reduction of 64.76% and 67.21%, respectively, the latter coming to a complete halt in five centers that had regularly provided this service. The drop in the cases occurred equally in both COVID-19-designated and –nondesignated hospitals.

PPE was available for all hospital workers in the triage area only in five among the surveyed centers, and only 58.3% of centers used full PPE during endovascular procedures. Stroke rehabilitation services, especially for outpatient care, were markedly affected in more than 53% of surveyed hospitals because of a lower number of personnel, fear among staff and patients, and poor access.

A comparison of the impact of COVID-19 on stroke care in India and the United States

The adverse impact of the SARS-CoV-2 pandemic on stroke care showed several similarities and differences between India, a developing country, and the United States. There are reports in the United States of a significant decrease in all acute stroke cases presenting to the emergency rooms at stroke centers,⁷ similar to reports in India. The magnitude of this decrease has been estimated in surveys to be around 30–40% in the United States, about two thirds of the reduction seen in the Indian survey. The larger magnitude of decrease in India is

Table 1. Changes in acute stroke care in selected high-volume stroke centers in India during the COVID-19 outbreak

Sl. No.	Institution	Average acute strokes in ER (per week)		Average IV thrombolysis (per week)		Average mechanical thrombectomies (per week)		PPE in triage area and acute stroke evaluation	Stroke care based on COVID-19 status	Use of PPE for thrombectomy personnel regardless of COVID-19 status	Changes in post thrombolysis/thrombectomy care	Changes in rehabilitation care in COVID-19 era
		Pre COVID-19	COVID-19 period	Pre COVID-19	COVID-19 period	Pre COVID-19	COVID-19 period					
1	All India Institute of Medical Sciences, New Delhi	28	8	6–7	1	1–3	1	No	COVID-19 positive and negative	No	Yes	Yes
2	Sree Chitra Tirunal Institute for Medical Sciences and Technology, Thiruvananthapuram	10–15	2–3	1–2	0	1	0	No	COVID-19 negative only	Yes	No	Yes
3	Postgraduate Institute of Medical Education and Research, Chandigarh	19	5	2	0	1	1	No	COVID-19 positive and negative	No	Yes	Yes
4	Jaslok Hospital and Research Centre, Mumbai	10	1	8	1	5	0	Yes	COVID-19 positive and negative	Yes	No	Yes
5	Zydus Hospital, Ahmedabad	6–9	2–3	2–3	1–2	0–1	0–1	Yes	COVID-19 negative only	Yes	No	Yes
6	National Institute of Mental Health and Neurosciences, Bengaluru	15	7–10	1–2	1–2	1	1	No	COVID-19 negative only	Yes	No	No
7	Government Medical College, Thiruvananthapuram	18–20	16–17	5–6	4–5	0	0	Yes	COVID-19 positive and negative	NA	No	No
8	Smt. NHL Municipal Medical College and Sterling Hospital, Ahmedabad	15–20	3–4	1–2	1	1	0	No	COVID-19 negative only	Yes	Yes	No
9	All India Institute of Medical Sciences, Jodhpur	6–8	2–5	2–3	< 1	< 1	0	No	COVID-19 negative only	No	No	No
10	KEM Hospital, Pune	10	4	5	2	2	<1	Yes	COVID-19 positive and negative	Yes	Yes	No
11	AMRI Hospital, Kolkata	5	1	1	0	0	0	No	COVID-19 negative only	No	No	No
12	Neuro Stroke and Critical Care Institute, Ahmedabad	10	4	2	1	1	1	Yes	COVID-19 negative only	Yes	Yes	Yes
13	Christian Medical College, Ludhiana	20	10	2–3	1	0–1	0	No	COVID-19 positive and negative	No	No	Yes

ER, emergency room; IV, intravenous; NA, not applicable; PPE, personal protective equipment.

deeply troubling, as India has a higher incidence of stroke compared with the United States.⁸ There is an approximately 50% decrease in all reperfusion therapies in the United States, including thrombolysis and thrombectomies, whereas these numbers are 64.76% for thrombolysis and 67.21% for thrombec-

tomy in India. Though the survey included both COVID-19–designated and –nondesignated hospitals, the possibility of triaging of stroke patients to nonstroke centers was likely to lead to poor outcomes. There is a clear similarity in both countries, however, in that neither country's public health

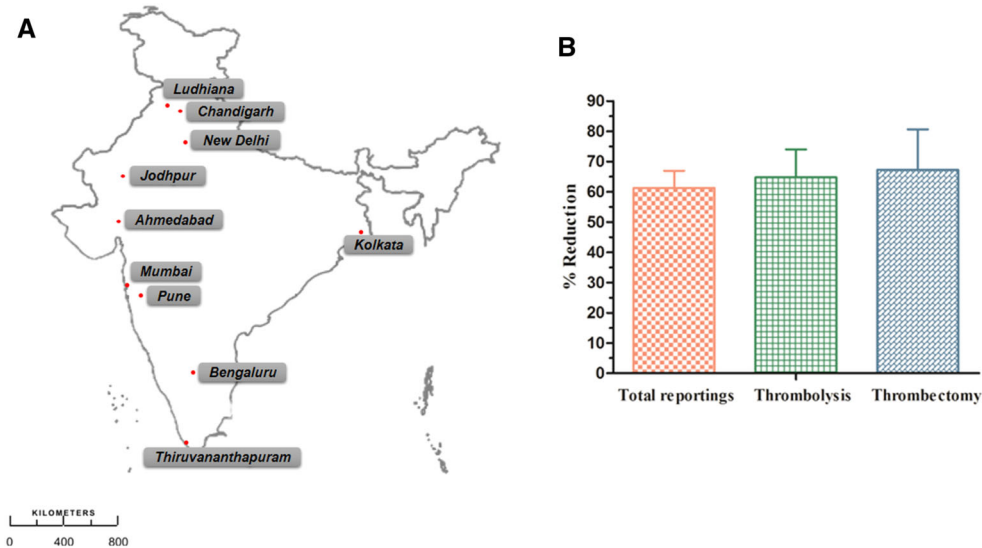


Figure 1. (A) Map of India showing the location of apex medical centers where the questionnaire-based survey was conducted (Map of India adapted from Bhuvan, ISRO). (B) Graph representing the percentage reduction of total reporting of stroke cases post-COVID-19, along with percentage reduction in IV thrombolysis and thrombectomies in apex medical centers across India.

system made proactive efforts to raise awareness among the public to *not* ignore life-threatening emergencies such as stroke during the pandemic, or efforts to deal with the developing atmosphere of fear of going to hospitals. This is likely because public health systems all over the world, regardless of country income levels, were completely unprepared for handling the pandemic and its impacts on other health conditions. This is one of the key lessons for all countries in developing future pandemic preparedness policies and protocols.

Challenges and solutions for stroke care in India during the pandemic

Acute stroke care

The extreme measures adopted to contain the spread of SARS-CoV-2 have resulted in a dramatic fall in the number of stroke patients reaching hospitals in India. A similar change in the pattern of stroke patients was noted in Italy, with more severe patients reaching hospitals and at longer times after onset.⁹ This may be mostly owing to patients with minor stroke and transient ischemic attack not seeking care because of unavailability of transport, fear of contracting infection, and financial liabilities. The lockdown has also created difficulty in timely

consultation with caregivers, leading minor stroke cases to remain undiagnosed.

India lacks emergency medical services; studies have shown that from 1.5% to less than 10% of patients reach hospitals by ambulance.^{10,11} The onset-to-door and treatment time is longer than before COVID-19¹² and it is likely to increase further, as observed in many severely affected countries, thereby compromising acute care.⁹ Stroke patients from remote areas of the country are at greater risk of not reaching hospitals because of the suspension of public transport.^{11,13}

Acute stroke care in individuals suspected of having COVID-19 is of special concern. According to the Ministry of Health and Family Welfare (MoHFW) Government of India guidelines, these cases are supposed to go to designated COVID-care government hospitals—several of them are in smaller districts and are state hospitals. Many of the COVID-19-designated hospitals either may not have facilities for acute stroke care or are not stroke ready. The consequent disruption of hyperacute stroke treatment requiring mechanical thrombectomy is particularly acute because resources are particularly strained: the bulk of endovascular therapy in India is provided by corporate hospitals,¹ which are currently excluded from caring for stroke

patients suspected of having COVID-19. Those patients who reach a healthcare facility having no stroke expertise are undertreated and need referral to higher-level centers, often after a considerable delay with unavoidable complications.¹⁴ As noted in many severely affected countries, the onset-to-door and door-to-treatment times are prolonged in the SARS-CoV-2 epidemic, compromising acute care.⁹

The reluctance of patients to report to hospitals is rooted in fears of acquiring SARS-CoV-2 infection and economic implications/consequences of hospital admission. Awareness campaigns to reeducate the public on the high morbidity and mortality of noncommunicable diseases (NCDs), including stroke, and the high risk of a second wave of mortality due to these illnesses, are essential. In virtually all stroke cases, however, the need to get timely care in hospitals supersedes the risk of possible exposure to SARS-CoV-2. Even when the “core” government machinery is directed toward the control of the pandemic, operating special ambulances and other emergency services could be a game-changer for acute NCD needs.

Stroke management guidelines would need to be followed with concessions made for changes in accessibility. Acute therapy may see an inevitable shift from larger centers to smaller, peripheral hospitals and from endovascular to more intravenous thrombolysis during the COVID-19 crisis. Moreover, especially in the case of suspected situations of hyperacute strokes, optimal use of telemedicine facilities would help ensure the services of stroke specialists even in peripherally located COVID-19-designated centers. Patients who present later with symptoms could be referred to designated stroke centers with facilities for isolation and concurrent COVID-19 care. The recent consensus statement of the Indian Stroke Association suggests organizing hospital stroke pathways during the ongoing pandemic.¹⁵

The risk of infectious exposure to clinical teams can be mitigated by adopting the Protected Code Stroke guidelines.¹⁶ Defined and designated areas for all stroke patients and screening by an emergency room physician for suspected COVID-19 symptoms, with full protective gear (full-sleeved gown, surgical mask, eye protection (face shield and/or goggles), gloves, and head cover), have been proposed.¹⁷ Since testing currently does not include

a point-of-care device, universal precautions to healthcare workers become even more crucial.

Poststroke rehabilitation

Recovery from a disabling stroke greatly depends on early and easy access to tailored, comprehensive rehabilitative measures, including physical, speech, and occupational therapies, especially in the initial 3–6 months poststroke.¹⁸ India has few rehabilitation centers, and most of the patients with mild-to-moderate strokes receive postacute rehabilitation at home or through outpatient clinics of large hospitals.¹⁹ The stroke recovery curves are likely to turn suboptimal, as patients will have even less access and availability to comprehensive rehabilitation facilities poststroke. The sudden interruption in rehabilitation may lead to other acute difficulties, including worsening of ambulation that patients may assume to be stroke recurrence, causing panic.

During the pandemic, hospitals are forced to complete treatment/evaluation and discharge patients early to minimize the risk of infection, which shortens or eliminates in-hospital rehabilitation services. Shifting of resources toward the care of COVID-19 patients has also resulted in fewer dedicated centers for assisting stroke patients. The ability of patients to avail the services of experienced therapists at home is also impaired by the lack of transport services and mandatory cessation of all nonemergency services during the lockdown. Trained speech and occupational therapists, who were scarce in normal circumstances, have become almost unavailable with the continuing cutback in travel. Here again, relatively weaker sections of communities are affected disproportionately, with subsidized government facilities being centered around COVID-19 care.

Developing a caregiver-driven stroke rehabilitation program has been attractive in India to address the scarcity of rehabilitation centers and trained therapists. Implementing such programs will be crucial in (and perhaps after) COVID-19 in order to avoid preventable disabilities. As one example, video- and app-based programs developed in the local language can facilitate home therapy.²⁰

Care of stroke survivors and risk factor control

Stroke review clinics across the country have been suspended to prioritize the care of COVID-19 cases. Curb of public transport and fear of SARS-CoV-2

infection prevent timely reviews even in areas where centers are active. Consequently, stroke survivors are facing difficulties in receiving follow-up care, which may lead to a surge in new cerebrovascular and cardiovascular events.

Poor accessibility to testing facilities for risk factor monitoring has rendered risk factor control challenging in the remote areas of the country. India has a higher burden of rheumatic heart diseases compared with developed countries; afflicted patients require vitamin K antagonists for anticoagulation and secondary stroke prevention.^{10,21} Hence, the proportion of anticoagulated patients using warfarin, acenocoumarol, or related drugs is likely to be comparable to those using nonvitamin K-antagonist or -anticoagulation.^{10,21} Patients generally have poor knowledge of the optimal use of anticoagulation and monitoring, which is likely to worsen further with decreased interaction with physicians.²² With both laboratory and hospital access hampered, adverse events related to both poor physical therapy maintenance and suboptimal vascular risk-factor control are likely to surface. Mental health issues have also come more to the fore, with depression and anxiety associated with separation from loved ones and fear for well-being, lack of money, and inability to work because of COVID-19 implications and consequences.²³

With India under lockdown, the availability of essential medications is also hampered. There are increased chances of stroke recurrence if patients fail to take their medications due to unavailability, limitations in venturing out to buy medications, and inability to reach public hospitals for prescriptions and refilling from free shops. The high demand for medicines, in turn, increases prices, making it difficult for some patients to attain essential medicines. This makes patients highly susceptible to availing medicines from unauthorized sources or even receiving incorrect medications.

Teleconsultation facilities are being set up in tertiary care facilities to ensure that patients receive timely medical advice and, more importantly, motivation and counseling to endure the crisis. Such stroke teleconsultation facilities should use the opportunity to reinforce the need to also continue preventive measures for NCDs and to see that timely treatment of life-threatening diseases like myocardial infarction and stroke is not compromised.²⁴ Government drug suppliers in India and defense

personnel are reaching out to ensure that available drugs reach the difficult-to-access locations in the country,²⁵ whereas political action is required to ensure the resumption of drug manufacturing. In many parts of the country, local administrations have established counseling centers to tackle depression and stress.²⁶ Interestingly, popular media are attributing the decrease in reporting of acute myocardial infarction and strokes to an actual reduction in incidence of both related to the improvement of certain risk factors: reduced consumption of fast food, more sleep, decreased environmental pollution, and lower work-related stress are touted as possible positive influencers.²⁷

Stroke care during COVID 19: shifting to telemedicine

Major developments in the field of telemedicine have taken place at a rapid pace during the COVID-19 crisis.²⁸ Telemedicine, by virtue of minimizing travel and reducing physical contact, provides a pragmatic advantage by avoiding in-person consultation of patients while providing access to both primary and specialist care. Electronic consultations (e-consults) thereby greatly assist in delivery of out-patient health care without compromising the benefits of specialty expertise, which can be readily made available to many patients.²⁹

Virtual consultations have further clear advantages. Concerns of patients with COVID-19 can be addressed and triaged, and individuals in quarantine or recently discharged to home can be provided care. For non-COVID-19 issues, telemedicine can provide care without the risk of exposure, which is a major concern for the old and those with chronic conditions. This could have a net effect of reduced exposure to patients and clinicians while limiting the demands of emergency departments.³⁰

One of the major concerns about telemedicine, especially in the West, has been to ensure privacy the Health Insurance Portability and Accountability Act of 1996 (HIPAA). In the United States, HIPAA noncompliant platforms have generally not been allowed. However, the U.S. Department of Health and Human Services recently waived potential penalties for HIPAA violations and declared that it would not enforce compliance rules during the COVID-19.³¹ Policymakers in India have also opened the route of telemedicine by a fast track issuing of

telemedicine guidelines.³² These guidelines provide authorization to use various telemedicine platforms by registered medical practitioners and hospitals. It, however, prohibits any technology platforms based on artificial intelligence or machine learning to counsel or prescribe medicines to patients.

Stroke management using telestroke platforms can be utilized in India to provide high-quality care for triaging patients, as well as the entire stroke care pathway, even in resource-poor settings.³³ As the number of COVID-19 patients continues to increase, there may be a greater resource crunch in the routine outpatient care of stroke patients, which may be avoided to a significant extent if telemedicine platforms could be integrated early on into health systems within the framework of the guidelines of the MoHFW, Government of India.

Conclusions

The COVID-19 pandemic has made stroke care even more challenging. Various facets of stroke treatment need reorganization to provide optimized services during such crises. There is a need for public health systems in both developed and developing countries to improve stroke awareness and to implement proper strategies of triage, acute treatment, well-defined rehabilitation plans, teleservices, and virtual check-ins. This will help maintain the continuum of care for stroke care and reduce morbidity and mortality.

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Competing interests

The authors declare no competing interests.

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