

Practice Implications for Acute Ischemic Stroke during the COVID-19 Pandemic for the Indian Scenario: Realistic and Achievable Recommendations by the Society of Neurocritical Care (SNCC), India

Gaurav Kakkar¹, Kapil G Zirpe², Harsh Sapra³, Subhal Dixit⁴, Chandril Chugh⁵, Sridhar Nagaiyan⁶, Prashant Kumar⁷

ABSTRACT

COVID-19 disease caused by the SARS coronavirus has caused significant morbidity and mortality around the world ever since it was first declared as a pandemic by the World Health Organization (WHO) in March 2020. Acute neurological manifestations of this disease have also started emerging and being recognized around the world and acute ischemic stroke (AIS) or thrombotic stroke is becoming one of the major neurological illnesses related to COVID-19. The management of AIS is time-critical and major advances in its management over the recent years, such as bridging thrombolysis and mechanical thrombectomy (MT), are multidisciplinary activities requiring robust coordination and management in the acute setting. All these advances are severely challenged in the COVID-19 pandemic where severe pressures exist on the clinical resources and logistics required to deliver an effective stroke service. This is further compromised by legal and preventive measures during this pandemic like local lockdowns. Reporting of minor or initial symptoms has also been compromised due to the fear of approaching healthcare settings which are perceived as high-risk zones to catch the infection. The purpose of this document is to highlight these challenges and provide a guiding framework for the management of AIS under three principles: (a) Delivering an effective service, (b) Preventing infections within the healthcare setting, and (c) Optimizing resource utilization.

Keywords: Acute ischemic stroke, COVID stroke pathway, COVID-19, Healthcare staff protection, Hyperacute stroke service, Mechanical thrombectomy, Neurocritical care, Thrombolysis, Thrombotic stroke.

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INTRODUCTION

Acute ischemic stroke (AIS) is a common neurological emergency that requires rapid and effective treatment usually delivered through dedicated stroke pathways or stroke teams in specialized hospitals, in order to achieve best neurological outcomes. This challenge of achieving and sustaining successful outcomes is greatly affected by the current COVID-19 pandemic which has swept humanity like never before.¹ This crisis is particularly alarming for India as we have a fragmented and under developed healthcare system that has a non-uniform delivery and regulatory platform across the country. Moreover, the gains of the hyperacute stroke service which were achieved, popularized, and accepted in recent times, now face serious erosion due to the widespread restrictions imposed due to the COVID-19 pandemic.² The incidence and prevalence of acute ischemic symptoms in the constellation of symptoms due to the COVID-19 disease also remains an unknown and evolving entity.³ Therefore, the purpose of this pathway and practice recommendations is to provide a framework to achieve:

- Delivery of a high-quality and safe stroke service using modifications in the time of pandemic.
- Safety of healthcare professionals and avoid contributing to the spread of the COVID-19 disease.
- Optimum utilization and conservation of healthcare resources including physicians, healthcare workers, and medical/intensive care beds.

^{1,3}Department of Neuroanaesthesia and Neurocritical Care, Medanta–The Medicity, Gurugram, Haryana, India

²Neuro Trauma Unit, Grant Medical Foundation, Pune, Maharashtra, India

⁴Department of CCM, Sanjeevan and MJM Hospital, Pune, Maharashtra, India

⁵Department of Interventional Neurology, Max Superspecialty Hospital, Delhi, India

⁶Department of Critical Care, Kauveri Hospital, Chennai, Tamil Nadu, India

⁷Department of Anaesthesiology and Critical Care, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak, Haryana, India

Corresponding Author: Gaurav Kakkar, Department of Neuroanaesthesia and Neurocritical Care, Medanta–The Medicity, Gurugram, Haryana, India, Phone: +91 9717413838, e-mail: gaurav_kakkar@hotmail.com

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DELIVERY OF A HIGH-QUALITY STROKE SERVICE IN COVID-19 PANDEMIC

The COVID-19 pandemic has thrown an unprecedented challenge in the delivery of routine healthcare services worldwide. The priority around all healthcare systems is to ramp-up capacity to safely treat COVID-19 patients and prevent virus transmission within healthcare settings. While this is the correct strategy, the treatment of routine diseases especially the management of emergencies like AIS have been affected around the world.⁴ There has been a reduction in the numbers of patients presenting with AIS to hospitals for treatment. Whether this is due to reduction in the pathology or it is due to reluctance in the general population to approach healthcare facilities, remains to be seen.⁵

Irrespective of the above fact, the numbers of AIS patients will start to emerge and there needs to be modifications in the way hyperacute stroke service should be run in the wake of the COVID-19 pandemic.

We strongly disagree in the concept of sending stroke patients with an unknown status or with a positive COVID-19 test to separate COVID-19 hospitals.⁶ This is primarily for two main reasons. First, the multidisciplinary expertise required to treat AIS would not be possible in any new COVID-19 hospital and would negate all the gains made recently in this hyperacute service in the country. Second, the time lost in transferring these patients from one hospital to the other is completely at odds to the basic principle of running a stroke service.

Prehospital Care for AIS Patients

The community awareness for patients to seek immediate help for suspected AIS symptoms should be ramped up during this pandemic. They should be encouraged to inform suspected symptoms and avail medical treatment without getting unduly intimidated by the COVID-19 fear prevalent in the society. The local feeding populations of each AIS center should be educated about the prevalence of routine presentations of stroke that can present as before during the pandemic and that it is ok to seek medical help for routine illnesses. Confidence-building measures should be undertaken for the patients to come to the treating hospitals which include details of the precautions taken, such as timely triage, full personal protective equipment (PPE), social distancing, and rapid testing. The medical- and pandemic-related information also needs to be updated to the general physicians of the local population so that timely presentation to the appropriate stroke centers can be performed promptly with due precautions taken for COVID-19. Telemetry or video consultations have a major role to play in this.⁷ Video consultations and their platforms should be widely publicized and efficiently used to diagnose suspected patients and guide them to seek emergency medical treatment at the earliest.

We strongly disagree in the concept of sending stroke patients with an unknown status or with a positive COVID-19 test to separate COVID-19 hospitals. This is primarily for two main reasons. First, the multidisciplinary expertise required to treat AIS would not be possible in any new COVID-19 hospital and would negate all the gains made recently in this hyperacute service in the country. Second, the time lost in transferring these patients from one hospital to the other is completely at odds to the basic principle of running a stroke service.

Instead, patients in the community should be encouraged to come to the usually treating centers with additional confidential-building measures. The hospitals should have guidelines in place

to treat such patients with full protection measures for the staff and the environment. In most healthcare facilities in India and for that matter around the world, it is impractical to look for separate CT scan or separate intervention suites for such procedures. Strict infection control protocols with full complement of PPE and adequate staff training to deliver the above is what is required to tide over this crisis while maintaining a quality stroke service.⁸ This inevitably would lead to some compromise in the quality standards of the usual service, such as “door-to-needle” time, but this is the balance that needs to be maintained between healthcare safety and service delivery.

Pathway for Hospital Treatment for AIS Patients

We propose a pathway for this decision-making that should be used as a guiding tool to deliver the service in the safest possible manner.

All patients with suspected stroke symptoms should be seen promptly by the stroke team or triaged quickly and referred to the stroke team. Full PPE is recommended at this stage in the emergency room (ER) as the COVID-19 status of the patient is unknown. The usual triage team is expected to be overwhelmed with pandemic patients, so the stroke teams of each hospital might need to become the receiving teams if prior information is available of such patients. Quick history of warning signs should be taken like the presence of fever or cough, contact with COVID-19 positive case, or travel to containment or suspected areas. The list of suspected symptoms is getting wider and the presence of asymptomatic carriers also makes it difficult to clinically identify suspected cases.

For all suspected stroke patients, complete hemogram and random blood glucose should be performed immediately. The presence of lymphopenia in complete hemogram would help further down in decision-making as it has shown to be an early marker of COVID-19-related disease patterns with increasing mortality.⁹ CT chest has rapidly gained popularity worldwide and has become a reliable screening tool for suspected COVID-19-related pneumonitis related findings with some studies showing good correlation between CT findings and subsequent positive results.¹⁰ It should be performed at the same time as CT head to see any indications of suspicious lung pathology, e.g., ground glass lung opacities or florid silent pneumonic patches. Most AIS centers are likely to have COVID-19 test available by now at their centers. If available, a rapid PCR test (GeneXpert) should be performed which can give results in 45–90 minutes. It might be prudent to wait or this test if available.

So, there are two key points in this pathway: The “rapid test” and the “decision time out”.

Rapid Test

The rapid test is a PCR-based GeneXpert test that can be performed with a nasopharyngeal swab and results can be expedited within 45–90 minutes at the earliest.¹¹ Until we have more technologically advanced tests in India that can give quicker results, this is the best time frame we have to diagnose a COVID-19 positive or negative patient who presents with AIS symptoms. This might not be available at all centers and clinicians should liaise with their respective microbiology labs to see the best expedited test in their scenarios.

Clinicians might want to wait or not wait and that decision should be taken at the local level given the risk to the staff and benefit to the patient in that given scenario.

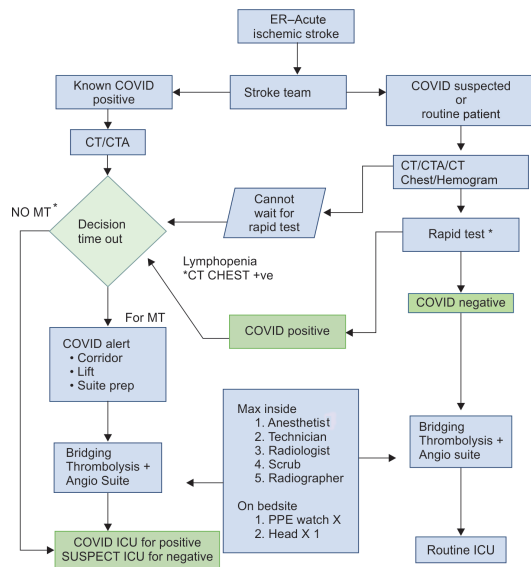
Time Out

The second key decision point is when the patient needs to proceed to the intervention suite after or during the bridging thrombolysis. At this point, we believe a pragmatic approach needs to be taken for a COVID-19 positive or a suspect patient as the journey to the intervention suite and the procedure would expose a number of healthcare staff and distinct benefit of the procedure should be a possibility over the risks being taken. Results from the CT chest and hemogram would help us, so if positive findings from CT chest and lymphopenia are seen then the patient should be treated as positive unless ruled out by a PCR test. Futile attempts in patients presenting out of the “window period” or with other serious comorbidities should not be taken given the risks involved to the staff. Hence, the above discussed 45 minutes wait for a “rapid test” might be prudent in such scenarios.

Apart from the above, a full set of PPE should be available to all team members and there should be appropriate training in “donning-on” and “doffing-off” techniques. Experience from around the world has suggested that a separate individual who monitors and supervises correct PPE procedure is helpful in reducing virus transmission.¹² In order for this to succeed in India, sufficient powers should be given to this individual to operate efficiently in “vertical hierarchy” organizations like those present in India.

Equally important are measures to reduce fomite infections and they include minimum reuse of equipment, such as thermometers and stethoscopes. Where possible minimum staff should get exposed in each scenario. Also important is that the patient should always have a surgical mask covering the nose and mouth at all times during the patient journey.

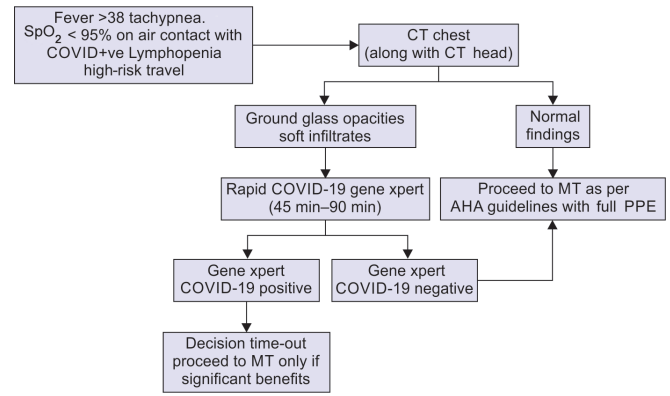
Clinical Pathway



*MT — Mechanical Thrombectomy

- Rapid test: GeneXpert test that can be expedited and give result in minimum 45 to 60 minutes if coordinated well. Timings might improve as more technology advances.
- *CT chest and lymphopenia in complete blood count (CBC) would aid decision-making.

Schematic Flowchart proposing the benefits of CT Chest



Safety of Healthcare Practitioners and Environmental Safety

It is imperative to maintain healthcare safety at all times and even so during this COVID-19 pandemic. Although hyperacute stroke service is a time-critical entity a balance has to be achieved between personnel safety and disease treatment in order to reduce the risk of virus transmission and disease spread among the healthcare delivery teams.¹³

There should be sufficient provision of appropriate PPE available to healthcare staff along with training and safety drills toward donning-on and doffing-off techniques in designated areas. A designated nurse or personnel must be appointed to critically monitor donning-on and doffing-off in sensitive areas, such as COVID +ve or COVID suspect zones or during high-risk procedures in such patients.^{12,13} Some healthcare systems have even used simulation drills to train staff in optimal and appropriate use of PPE.¹⁴

Also important is the time spent in close contact to a positive or suspected patient. Close contact has been referred to as a “distance less than 6 feet or 2 meters” and less than 15 minutes time spent more than 6 feet apart with at least an FFP2 mask has shown to reduce the infective rates of COVID-19 and is now being considered low risk for infection spread.¹⁵

The principles of transmission and protection are summarized in Table 1. Published data show that SARS-CoV-2 virus maybe present and can survive in droplet nuclei up to 3 hours. However, the contribution of droplet nuclei in transmission is currently uncertain. Standard surgical masks may not be effective in preventing inhalation of droplet nuclei because they are not designed to provide a tight face seal and to filter out particulates in the droplet nuclei. Particulate filtering facepiece respirator which include N95 (United States), FFP2 (Europe), KN95 (China), P2 (Australia/New Zealand), K94 (Korea KMOEL), or DS (Japan) are preferable especially for aerosol-generating and other high-risk procedures. Using surgical mask, gloves, gowns, and hand washing was effective in the prevention of nosocomial transmission of severe acute respiratory syndrome in 2003 with no superiority demonstrated for particulate filtering facepiece respirator. The Surviving Sepsis Campaign Guidelines on the Management of Critically Ill Adults with COVID-19 recommend a minimum of a surgical/medical mask for healthcare providers caring for non-ventilated COVID-19-infected patients

Table 1: Infectivity, risk, and protection

Size of coronavirus: 0.125 mm (SARS-CoV and MERS-CoV)
Route of infection: Inhalation and mucous membrane penetration
Method of transmission:
<ul style="list-style-type: none"> • Contact (direct-touching the skin of other people or indirect-objects contaminated with infectious droplets and then touching the eyes, nose, or mouth). • Droplets (>5 mm) through coughs or sneezes droplets onto themselves, other people, or nearby surfaces. • Droplet nuclei (1–5 mm) unclear if role in transmission.
Penetration through particles <100 mm in size can enter the nose, mouth, and throat and are considered “inhalable”.
Particles <10 mm can reach the large bronchioles and are considered the “thoracic” fraction.
Particles <5 mm can enter the deep lung and are considered the “respirable” fraction.
Close contact:
Approximately 6 feet (2 meters) of a COVID-19 case for a prolonged period of time; close contact can occur while caring for COVID-19-infected patient; or having direct contact with infectious secretions of a COVID-19-infected patient.
Maximum risk:
Performance of aerosol-generating procedures.
Intermediate risk:
Entering the room of a COVID-19-infected patient. The risk may vary depending upon the room. Isolation rooms, angiographic suites, and operating rooms.
Medical transport workers transporting patients with suspected COVID-19 -infected patient.
Low risk:
Other parts of hospitals or other healthcare facilities where there is no direct contact with patients.
Basic protection:
Surgical masks, safety glasses or goggles (capable of protection from aerosols from all sides), and face shields shield the healthcare worker’s mucous membranes (eyes, nose, and mouth) from large sprays of blood and other body fluids.
Advanced protection
Particulate respirators if transmission via droplet nuclei or in close proximity to droplets:
<ol style="list-style-type: none"> 1. A filtering half facepiece (sometimes called a disposable respirator), where the filter is virtually the entire respirator. 2. An elastomeric (reusable) half facepiece with a particulate filter. 3. An elastomeric (reusable) full facepiece with a particulate filter. 4. A powered air-purifying respirator that includes a particulate filter.
Rating of respirators “N”, if they are not resistant to oil, “R” if somewhat resistant to oil, and “P” if strongly resistant (oil-proof).
Implications for coronavirus the SARS virus has a “shell” composed of lipids, which are fats and oils. However, the amount of fat and oil in these tiny virus particles is extremely low and is not enough to affect the filter in the N-series respirator.
Levels of filter efficiencies 95% (N95), 99% (N99), and 99.97% (N100 or HEPA filter) tested against aerosol (fine mist) droplets 0.3 mm in diameter.
Strategies for effectiveness fit-testing and training of each worker in the use, maintenance, and care of the respirator.

and during performance of non-aerosol-generating procedures on mechanically ventilation (closed circuit).¹⁶

Telemetry or telestroke as an integral part of stroke systems of care telestroke has demonstrated equivalence to that of a bedside assessment for immediate assessment of stroke severity using National Institutes of Health Stroke Scale (NIHSS) and to determine intravenous recombinant tissue plasminogen activator (rt-PA) and/or thrombectomy eligibility.^{7,17} Use of the low-cost smartphone application system is another option for the rapid clinical assessment in acute stroke care.¹⁷ The use of telestroke must be maximized in the current situation because all aspects of acute stroke evaluation can be performed. Institutions may explore with the ethics committee or Institutional Review Board whether commercially available low-cost smartphone application systems can substitute when telestroke networks are not available.

Environmental Contamination

Keeping the treatment environment clean and sanitized is another challenge to reduce the risk of transmission of COVID-19 within the healthcare settings. Stringent adherence to cleaning protocols needs to be made to reduce this risk.¹⁸

The problem of false-negative tests and the emergent nature of the stroke pathway makes it mandatory to decontaminate clinical areas after every procedure (Table 2). Where possible single-use equipment should be used which can be disposed postprocedure. Cost and availability implications may necessitate reuse of certain equipment in which case they should be disinfected appropriately. Fixed or immovable equipment in either interventional suite or other areas also need to be disinfected in the same fashion. The disinfectant of choice should be either 1% sodium hypochlorite or scrub solutions that contain at least 70% alcohol.¹⁹ Strict compliance needs to be maintained in order to reduce the risk of transmission. To reduce the risk of fomite infections, personal items of either the staff or the patient need to be minimized and sanitized in the same way.²⁰

Centralized air conditioning may recirculate viral materials in droplets from patients to unaffected individual and care providers due to inward direction of air flow. Significant contamination (SARS-CoV-2 viral RNA) from patients has been seen in air samples and surface. Use of high efficiency particulate air (HEPA) filters and negative pressure ventilation might reduce the risk of transmission but the evidence for this is not strong.²¹

It is advisable to have a separate corridor and lift from the triage to the intervention suite where possible as COVID-19 test results might not be available due to the emergent scenario. This minimize the exposure of the remaining healthcare setting to the emergent patient in case this was to be positive later on.

Assuming and treating all emergency cases as high risk is more practical for the Indian scenario where the luxury of portable CT scans or separate radiological suites are not an option for most of the institution.

Resource Utilization²²

- There needs to be optimal staff utilization during this COVID-19 pandemic to delivery healthcare services. Where possible elective surgeries that can wait should be deferred to divert staff toward emergency duties and also to reduce the risk of exposure of the staff to the novel virus.
- The workforce planning should be performed in a staggered way to reduce all staff being present at similar times.

Table 2: WHO recommended frequency for cleaning of healthcare environmental area with COVID-19 suspect or confirmed case

	<i>Patient area</i>	<i>Frequency</i>	<i>Additional guidance</i>
1	Screening/ triage area	After every patient use and terminal clean at the end of the day where possible	<ul style="list-style-type: none"> Focus on high-touch surfaces then floors last
2	Operating theaters/ intervention suites	After every patient use and terminal clean at the end of every day	<ul style="list-style-type: none"> High touch to low touch then floor last Disinfect operating table and equipment thoroughly after every use and terminal clean at the end of the day
3	Inpatient (occupied)	At least twice daily, preferred thrice in case of high-touch areas	<ul style="list-style-type: none"> Focus on high-touch surfaces starting with shared, then move to each patient bed (use fresh cloth) then floor (last) Waste and linen removed, bed thoroughly cleaned every day
4	Inpatient (unoccupied/ terminal clean)	Upon discharge/ transfer	<ul style="list-style-type: none"> Low-touch surface, high-touch surface, floor in that order Waste and linen removed, bed thoroughly cleaned every day
5	Outpatient/ ambulatory areas	After each patient visit and terminal clean at the end of the day	<ul style="list-style-type: none"> Floor, linen, equipment, examination bed deep cleaned at the end of each day
6	Hallways/ corridors	At least twice daily	<ul style="list-style-type: none"> High-touch surfaces including railing and equipment in hallways followed by floor
7	Patient bathrooms/ toilet	Private rooms: Twice daily Shared toilets: Thrice daily	<ul style="list-style-type: none"> High-touch surfaces including door handles, light switches, counters, faucets, then sink bowls, then toilets, then floor (in that order) Avoid sharing toilet between staff and patients

- Also, important is to maintain the basic principles of hand hygiene and social distancing within the hospital premises like operating rooms and refreshing areas like coffee rooms, etc., with the same vigor as it is being performed outside.
- Provisions should exist and encouraged for staff to declare any viral transmission symptoms and take appropriate leave so that minimal workplace infections occur. Any attempts to work with positive symptoms or sickness should be strongly discouraged.
- Healthcare staff working in COVID-19 positive or suspect areas should not be rostered to work in other areas and should have adequate quarantine time-off after their designated work schedules.
- Robust contact tracing should be performed for suspected or positive cases by the infection control department to minimize spread.

When we know very little about this disease, the above measures when strictly followed have helped quite a few institutions around the world to resume service or even control their intrahospital healthcare infections.

Summary Recommendations

Prehospital

- Awareness of local population that stroke can still happen during this pandemic.
- Confidence measures should be conveyed to the population that it is safe to approach hospitals where all necessary precautions have been taken to reduce and treat the spread of COVID-19.
- Clear message to approach designated stroke centers and (not COVID-19 centers) if suspicion of stroke symptoms.

Clinical Pathway

- Stroke teams to receive the patient where possible or take earliest handover from ER teams who are busy with pandemic patients.
- Full PPE at the receiving point as COVID-19 status unknown.
- CT CHEST and Complete Hemogram should be performed as part of the urgent workup.
- RT-PCR: If available should be sent promptly preferably the GeneXpert which is likely to give results in 45–90 minutes.
- Time Out: A pragmatic decision time out is required to balance treatment benefits and infectivity risks. Findings from CT chest/lymphopenia/RT-PCR can all guide if MT would benefit.
- Forward March: For all suspected or positive cases, prior warning should be given to prepare the corridors, lifts, intervention suite so that they are fully prepared and protected.

Staff Protection and Environment

- Donning/Doffing Officer: Dedicated person to supervise correct donning-on and doffing-off procedures and ensure PPE compliance to reduce viral transmission.
- Optimum resource utilization to ensure minimum staff are exposed and a distance of 6 feet is maintained where possible with contact time less than 15 minutes where possible.
- Environment decontamination with 1% sodium hypochlorite or 70% alcohol-based solutions.
- Counseling and Support for healthcare staff should be ensured so that they feel motivated and valued.²³

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