



Proposed Model to Improve Acute Stroke Care in Central India

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Abstract

Keywords

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There is an urgent need to develop a national program and allocation of resources to improve stroke care in India. Management of stroke requires a multidisciplinary approach and close collaboration not only among physicians from different specialties but also among paramedical personnel and patient transport services. Here we propose a healthcare model of providing acute stroke therapies to patients in central India to minimize the wide supply mismatch we face in providing adequate care to our patients. Observations and the proposed model presented below were based on personal experience and a review of the literature on stroke care available in central India.

Introduction

Stroke is the most common cause of disability worldwide and the leading cause of death along with ischemic heart disease.¹ In India, the Indian Global Burden of Disease Study 1990 to 2019 estimated that stroke was the largest contributor to disability-adjusted life years, and a chief contributor to deaths caused by neurological disorders. The stroke burden is increasing in low- and middle-income countries (LMIC). Most strokes occur in LMIC, and the subsequent disease burden is greater in LMIC as compared with developed countries.

A systemic review published in 2021² demonstrated that the crude incidence of stroke ranges from 108/100,000 to 172/100,000. Most strokes in India are ischemic strokes. The fatality rate from stroke is reported as high as 30% and a greater number of stroke survivors suffer from moderate-to-

severe disability and are left with disability incompatible with independent life.

As mentioned above, ischemic stroke is a common cause of stroke, and large vessel occlusion is a common cause of ischemic stroke.³

Treatment of stroke evolved rapidly in recent years. In patients with large vessel occlusion, cerebral perfusion restoration is critical and the most crucial factor in reducing morbidity and mortality. Restoration of cerebral perfusion through mechanical or pharmacological thrombolysis is the standard of care in eligible patients. The morbidity and disability from a stroke can be reduced with timely intervention in a dedicated stroke center staffed with dedicated teams. Centers with capabilities to perform pharmacologic thrombolysis are only located in big metropolitan cities in India.

Central India in particular faces major challenges in providing care to stroke patients in a timely fashion, which

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includes but are not limited to a lack of organized data and registry for stroke care, a wide demand–supply mismatch, and the need for well-trained personnel and dedicated units along with modern equipment.

However, pharmacologic thrombolysis is increasingly available in India. Centers with capabilities of mechanical thrombolysis are scarce. Mechanical thrombolysis is not available even in metropolitan cities in central India.

The population of India is estimated to be around 137.5 crore and considering that the rough incidence of stroke is 150/100,000, the estimated incidence of acute stroke is around two crores, nearly half of these patients will be eligible for and will benefit from acute stroke interventions.⁴

Design

The essential steps in improving acute stroke care are as follows:

- 1) Public awareness and patient education for early recognition of stroke symptoms.
- 2) Timely transport to hospitals and centers equipped with ability to administer pharmacologic and intravenous thrombolysis along with clot evacuation and emergency neurosurgery and radiology services.
- 3) Access to stroke imaging: Computed tomography (CT) angiography, and magnetic resonance imaging) brain
- 4) Access to stroke interventions
- 5) Faculty and staff training and education
- 6) Post-stroke care and physical therapy and rehabilitation

Public Awareness and Patient Education

Public awareness can be raised through targeted campaigns; BEFAST (Balance, Eyes, Face, Arm, Speech, Time) is the most used campaign in Western countries to detect and triage stroke patients. Stroke campaigns should include television and radio advertisements and display posters in public places. In a study from Rajasthan, only 52% knew that their loved one is suffering from a stroke and only 2% knew about thrombolysis.⁵

Advanced Medical Priority Dispatch System

A substantial proportion of the population in India lives in rural and semi-urban areas.

The existing medical priority dispatch system can be improved to transport patients to the nearest IV thrombolysis capable center and mechanical thrombectomy center. Paramedical staff can be educated for prompt recognition of stroke symptoms and transfer patients to the nearest stroke center. In a recent study, 49% of patients reach the hospital through personal transport. Only a small percentage of patients arrived in the ambulance service.⁶ One of the major achievements of the national health mission in India is the patient transport ambulance operating under dial 108 and 102. Dial 108 is an emergency response system, primarily designed to attend to patients who are critically ill. It could be used as a great resource to transport patients to dedicated and specialized stroke centers efficiently.

The crew can be trained to identify acute strokes utilizing BEFAST and cheap technologies like Zoom and WhatsApp can be used to provide telemedicine consultation. Telemedicine for stroke management is a level 1 class A recommendation in American Heart Association (AHA) guidelines.

Acute Stroke Interventions Cost

According to National Health services (NHS) data in the UK, the cost of mechanical thrombectomy devices ranges from \$ 709 to \$1300 for catheters and \$2000 to \$3000 for stent retriever per case. In India, the procedural cost is around Rs 200,000 to 300,000.⁴ The acute stroke therapies can be integrated into national insurance schemes like Ayushman Bharat, and private insurance companies should be encouraged to cover the cost of acute stroke therapies. Although acute stroke therapies appear to be costly, several analyses proved their cost-effectiveness after considering serious morbidity and disability caused by stroke. In a study published in Western population, the net monetary benefit in patients treated with mechanical thrombectomy stands between \$74,000 and \$132,624.⁴

Equipment

Most of secondary care centers in India are equipped with CT scan machines. Intravenous thrombolysis can be provided in all centers equipped with CT scan machine; thereafter eligible patients can be transferred to tertiary care centers equipped with mechanical thrombectomy suite. The average estimated cost of biplane equipment ranges from 12 to 15 crore Rupees. There is urgent need to identify tertiary care centers in central India that could be developed in to stroke centers and could serve as a potential referral center for providing acute stroke therapies to eligible patients.

Faculty and Personnel

The stroke center team should include:

1. Stroke data manager and quality control personnel.
2. Director of stroke program.
3. Neurologist.
4. Neurosurgeons.
5. Neuroradiologists.
6. Radiology technician.
7. Stroke nurses.
8. Physical therapist.
9. Speech therapist.
10. Occupational therapist and rehabilitation experts.
11. Incontinence nurses.
12. Wound care experts.
13. Speech therapist.

Most of the above-mentioned human resources are already present in tertiary care centers. For the stroke center, additional human resources needed include stroke data manager and quality control personnel and director of stroke program.

Stroke data manager and quality control personnel will collect and maintain data and will play pivotal role in achieving quality metrics and will coordinate stroke care protocol with other services like emergency medicine and casualty, neurology, neurosurgery, radiology, and nursing. Since there is ample data to suggest that efficacy of acute stroke therapies is time dependent, there will be a great need to identify causes of delay and potential areas of improvements in providing acute stroke therapies as soon as possible. Stroke coordinator can be recruited as a class 2 officer and preferably should have experience in working in healthcare sector. Stroke coordinator should preferably hold a nursing degree.

Faculty: Stroke program faculty will be trained in minimally invasive stroke interventions, and stroke program doctors will be recruited from neurology, neurosurgery, and radiology. Nodal center should have two to three trained faculty members for adequate coverage.

Along with neurologists and radiologists, neurosurgeons play pivotal role in the management of patients admitted with ischemic and hemorrhagic strokes; their services are underutilized in acute stroke care. In a meta-analysis of data from seven randomized trials, the odds of achieving modified Rankin scale score of 0 to 3 at 6 to 12 months post-randomization were twofold greater among those randomized to hemicraniectomy than those assigned to best medical treatment. The survival benefit was even greater; the odds of survival after hemicraniectomy were fivefold greater among those randomized to hemicraniectomy than those assigned to best medical management.⁷ The current data from the United States suggests that hemicraniectomy is underutilized for malignant infarction.⁸ Utilization data from India is not available.

Intracranial hemorrhages (ICH) account for approximately 20% of strokes. These are associated with high morbidity and mortality; prompt identification of raised intracranial pressure and management of developing hydrocephalus are important for mortality and morbidity benefit. In a recently published review of spontaneous ICH, 23% of patients with primary ICH and 55% with associated Intraventricular hemorrhage developed hydrocephalus.⁸

Although initial trials including surgical trial in lobar intracerebral hemorrhage (STICH) 1 and STICH 2 trial did not prove statistically significant favorable outcome with early hematoma evacuation versus conservative management, there was trend in favor of hematoma evacuation in STICH 2 trial, 41% in the surgical management group versus 38% in the conservative management group; $p = 0.37$.⁹

Efficacy and Safety of Early Minimally Invasive Removal of Intracerebral Hemorrhage (ENRICH) trial results were recently unveiled in the American Association of Neurological Surgeons meeting at Los Angeles in April of 2023; this is the first clinical trial to prove the functional benefit of surgical clot evacuation among participants with supratentorial ICH presenting within 24 hours of last known normal. Minimally invasive trans-sulcal parafascicular surgery (MIPS) was considered safe, resulted in substantial

clot evacuation, and improved the utility weighted modified Rankin Scale at 6 months compared with standard management. The overall benefit of MIPS appears to be from the strong positive effect observed for participants with lobar ICH.

Therefore, since patients suffering from acute strokes need multidisciplinary approaches to maximize their chances of survival and functional recovery, it is imperative that we recognize and develop dedicated stroke centers and stroke units in our tertiary care centers.

We propose that we identify tertiary care centers in central India, which can function as stroke hub and can provide acute stroke therapies. These centers can be pivotal in improving care in rural and remote areas through telemedicine and modern communications equipment.

It is imperative to set up dedicated stroke units in the country. As a part of the national program for prevention and control of diabetes, cardiovascular diseases, stroke units and stroke care wards can be set up in district hospitals. District hospitals with CT scan machines can act as primary centers for intravenous thrombolysis.

Challenges in rolling out such a model in central India will include allocation of funds, lack of trained personnel, lack of equipment, and infrastructure.

Conclusion

Mechanical and medical thrombolysis along with clot evacuation for acute stroke is among one of the most revolutionary therapeutic advances in the field of stroke medicine; here we propose healthcare model of providing acute stroke therapies to patients in central India to minimize the wide supply mismatch that we face in providing adequate care to our patients.

Conflict of Interest

None declared.

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