6 Application of Telemedicine in the Management of Stroke

6.1 Scope and Purpose

Stroke is an episode of acute neurological dysfunction caused by focal cerebral, retinal or spinal infarction or haemorrhage. Stroke is preventable and can be effectively treated with early detection and management. Stroke leads to significant disability and poses a huge burden to the society and caregivers.

Since the availability of specialized centres for acute stroke care may be limited and far from an index patient's residence, telemedicine is an important bridge that could help make a quick decision by the local physician to treat or transport the patient to a specialized centre. This guideline explains broad principles of using telemedicine for stroke ('Telestroke') and aims to provide a uniform patient assessment and care pathways for point-of-care acute stroke therapy, risk management, and post-stroke care to reduce morbidity and mortality. In addition, it facilitates follow-up care and rehabilitation of stroke patients.

These guidelines shall fall within the broad perspective of the telemedicine guidelines laid down by the Medical Council of India (6).

6.2 Broad objectives of Telestroke

1. Acute stroke care can be implemented using telemedicine by primary, secondary care hospitals in government and private sectors and the health care providers can use telemedicine for
   a. Diagnosis of stroke and assessment of stroke severity
   b. Guidance from tertiary care physicians/neurologists for providing emergency care, stabilizing patient and monitoring for stroke care, or referral for further management
2. Teleconsultation for acute neurological deficits/stroke should aim to guide family caregivers/ primary care physicians in triage and timely referral to the nearest health care facility with CT scan/infrastructure round-the-clock that can provide acute thrombolysis. Those hospitals capable of offering acute stroke management could be stratified in to

a. Primary Stroke Centre (PSC)
b. Comprehensive Stroke Centre (CSC) (see Annexure in page no 73 for definitions and scope)

Telestroke systems may also facilitate acute treatments by improving team communications between a hub (CSC), and spoke hospitals (PSC)

3. Telemedicine is also useful for post-stroke care through direct consultation of patient with physician or health care provider or through their primary care physician / healthcare providers (like Physiatrist - Physiotherapist / Occupational therapist / Speech-language pathologists / Nutritionist) with the expert in tertiary care.
4. Teleconsultation by physicians in PSC with experts in CSC is feasible for guidance and monitoring of stroke care. This may be established in respective districts through a hub and spoke model. This requires that the physicians and healthcare facilities that act as 'spokes' are trained in stroke management.

6.3 Organization of Telestroke network

The broad organization of telestroke could be considered under the following heads

6.3.1 Infrastructure

The infrastructure for telestroke consultation and management shall depend upon the situation and need for specific consultation. This could be provided using the following-

1) Audio call
2) Audio and video call
3) WhatsApp or any other portal of encrypted data transfer of laboratory reports +/- Imaging
4) Imaging transfer tool for rapid communication of high-quality imaging of the stroke patient
5) Government of India or State Government portal specifically designed for teleconsultation (eSanjeevani)
6) The tool could be very basic or specifically designed using the latest technology with faster data transfer ensuring safety and privacy.

6.3.2 Clinical support tools required for telestroke

Clinical support tools for management of acute stroke are likely to be available in the PSC or CSC facilities (see Annexure in page no 73 for the scope of service at different level of stroke care)

These could include the following-

a. Investigations – ECG, ECHO cardiogram, access to CT scan, Lab tests
b. Monitoring tools – Oxygen saturation, blood glucose, BP measurement, swallowing assessment
c. Drugs – IV thrombolysis, antiplatelets, anticoagulants, antidiabetics, antihypertensives, lipid-lowering agents
d. Stroke unit
e. Interventional neuro and radiology facility for specific patients with large vessel occlusion
f. Stroke rehabilitation facility

6.4 Telestroke in different situations

6.4.1 Telestroke for training on the recognition of stroke by community members and lay people

The following important symptoms should be emphasized in the community to recognize the stroke symptoms.

1. Numbness or weakness (paralysis), especially on one side of the body, including face
2. Loss of consciousness or altered consciousness
3. Decreased vision in one or both the eyes
4. Language difficulties, either in speaking or understanding
5. Difficulty walking; loss of balance or coordination
6. Confusion or loss of memory
7. Swallowing difficulties
8. Sudden severe headache with no known cause
9. Sudden severe nausea and vomiting especially with headache or dizziness

A six-lettered word "BEFAST" may be used for quick recognition of stroke even by a lay person to seek urgent medical attention -

B= Balance (unsteady gait)

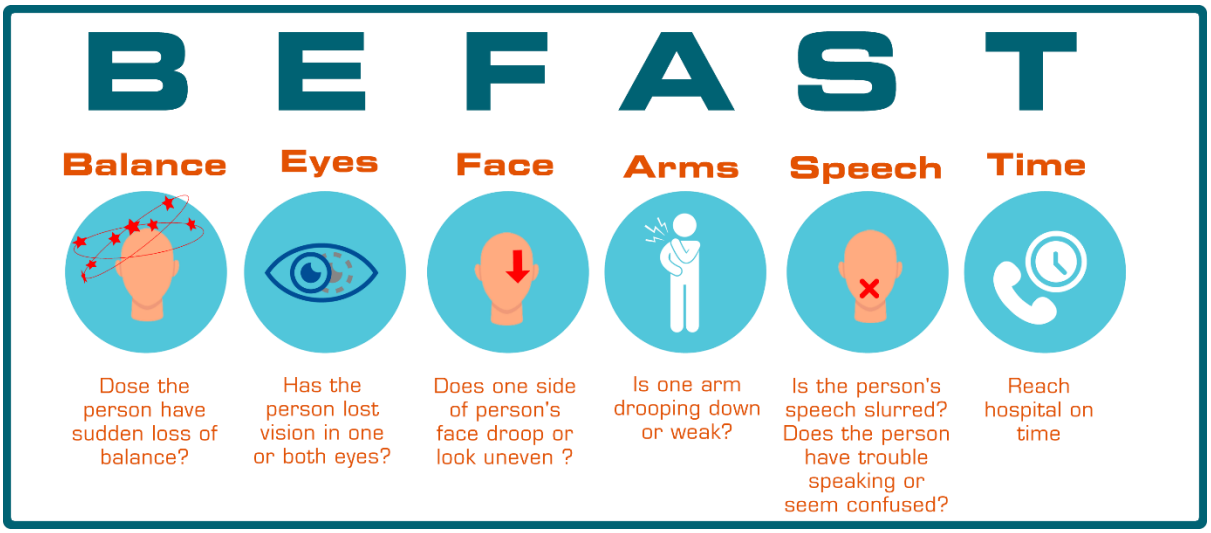
E= Eye (difficulties in vision, in one eye or one side of the visual field)

F = Face (drooping of face while smiling or showing teeth)

A= Arm, (drooping one of the outstretched arms)

S= Speech (slurred/garbled speech or inability to speak or understand commands)

T= Time (if any of the above alone or in combination are present and of sudden onset, this could be a stroke, and the patient should be transported to nearest hospital with stroke management facility)



6.4.2 Training of the doctors

Telemedicine could be an extremely helpful tool in teaching and training of physicians and neurologists at all levels of healthcare. At the primary care level, recognition of stroke, symptoms, severity and timely referral to the nearest stroke centre (PSC) should be in the training module. At the PSC and CSC level, it would involve training for acute stroke therapy using medical, interventional or surgical therapy as required. This will help empower training to reach out to all levels of the medical community.

6.4.3 Acute stroke management

Acute stroke care could be delivered using telestroke services by the following means-

- The basic principle will be built on a hub and spoke model for reaching out to the most remote places.
- Transfer of patient to the nearest facility by rapid teleconsult and decision making
- Using audio and video consultation with the nearest higher level of health care (PSC or CSC) for expert consultation and timely decision-making to treat. The consultation would involve history and clinical review, tele National Institute of Health Stroke Scale (NIHSS) and imaging transfer for quick review and decision-making to treat with intravenous thrombolysis or any other specific intervention as required.

Stroke is an emergency, and 'Time is Brain'. Any health care provider in any clinical setting should be able to triage for preliminary diagnosis and management. At the very basic level, the following could be immediately done -

a) Assess and manage ABCs (Airway, Breathing, Circulation)
b) Initiate cardiac monitoring
c) Maintain Oxygen saturation > 94%
d) Establish Intravenous (IV) access
e) Measure blood glucose and treat hypoglycaemia, if any
f) Determine the time of symptom onset or last known normal and obtain family contact information, preferably by a cell phone
g) Triage and RAPID TRANSFER of patient to the nearest PSC for acute thrombolysis or any other intervention and management of complications as required

Using mobile stroke unit service is also based on the premise of teleradiology and telemedicine with the treatment of acute stroke at the level of the community with timely dispatch to the nearest higher-level health facility. This is based on the concept of bringing the hospital to the patient.

Teleconsultation for the acute visit would include the following components as a part of comprehensive in-hospital stroke management. This could be well organized using teleconsultation for expert guidance.

a) Presenting complaints including time of onset or last seen normal
b) Any cardiac symptoms, relevant past history, comorbidity and medication history including anticoagulation
c) Quick neurological examination for deficits/ NIHSS/ modified Rankin Score (mRS) as relevant that is possible in virtual mode
d) Investigations: A non-contrast CT brain is mandatory. A CT angiogram or MRI brain may be done in selected cases based on ready availability but additional imaging should not be attempted which may delay the thrombolysis treatment
e) Medications: antiplatelet; anticoagulants as indicated; control of risk factors: hypertension; diabetes mellitus; cholesterol management etc
f) Lifestyle modification; exercise; smoking and alcohol cessation
g) Patient education and caregiver education

Annexure (page 73-89) provide detailed note on management of stroke from PSC level to CSC level.

6.4.4 Telestroke for post-stroke care and advice, including optimum secondary prevention and rehabilitation

This could be divided into two important components-

- Telestroke for the first-ever consultation for a previous stroke not investigated or evaluated. This would follow the same principles as stated in acute stroke management (section 6.4.3)
- Telestroke for follow-up consultation

The focus of follow-up consultation includes the following

1. Optimum secondary prevention based on the presumed stroke mechanism and review of any post-stroke complications. The secondary prevention would include overview or prescription for medications, including the following as per the specific need of the patient.
    a) Antiplatelets including aspirin and/or clopidogrel in ischemic stroke
    b) Anticoagulants (in cardio embolic stroke). Vitamin K Antagonist (VKA) or Novel Oral anticoagulants (NOAC) according to indication / preference / availability and affordability
    c) Antihypertensives
    d) Antidiabetics
    e) Lipid-lowering agents (statins/fibrates)
    f) Vitamin B12 / Folvite / D3 supplements as required
    g) Cessation of smoking/Alcohol consumption
    h) Carotid endarterectomy (CEA) and/or Carotid Artery Stenting (CAS) in cases of > 50% symptomatic carotid artery stenosis
    i) Management of cardiac ailments leading to embolic stroke
    j) Management of vasculitis/angiitis as required
2. Assessment of functional status Modified Rankin Score (mRS)
3. Recording of new complaints
4. Review of lab investigations
5. Changes in prescription
6. Follow-up investigations

7. Patient and caregiver education
8. Evaluation and urgent referral for any acute deterioration related either due to neurological or other medical reasons
9. Rehabilitation
    - Physiotherapy
    - Speech therapy/ Swallow therapy
    - Occupational therapy
    - Vocational training

6.4.5 Telestroke for assessment of patient care optimization

Patient outcome goals may be based on standardized stroke performance measures, as explained below. These require careful assessment, planning and implementation through in-hospital stroke management and post-stroke follow-up of patients using the following Standardized Stroke Performance Measures.

- Demonstration that rt PA was considered including Door-to-CT and Door-to-needle time
- Antithrombotic medication within 48 hours of hospitalization
- Lipid profile during hospitalization
- Deep vein thrombosis prophylaxis
- Discharge on antithrombotics
- Anticoagulation therapy for patients with AF/other cardioembolic stroke
- Screen for dysphagia
- Stroke education
- Smoking cessation
- Demonstration that a rehabilitation plan was considered
- Adherence to a healthy diet and exercise plan in people with risk factors
- Regular screening of the person for risk factors according to the protocol
- Maintaining the blood pressure levels, serum cholesterol and blood sugar levels within normal limits
- Good adherence to the protocols for screening complications
- Prevention of development of complications
- Improving the quality of life through disability limitation and rehabilitation in patients with complications

6.5 Challenges of telestroke

Setting up a hub and spoke model, integrated framework and network for stroke management requires the necessary technology set up, and accessibility to such technology. Training of health care workers and also the common people to recognise stroke and prompt arrival to hospital is very important. Training of the health care personnel at PSC from Emergency Department (ER) level to the stroke team is also another challenging area. The cost of treatment and management of stroke is also an important concern. The primary health care system and its weaknesses need to be addressed. Most importantly, there is need to disseminate information on telestroke to empower community, so that it is accepted as a system of care.

ANNEXURE

1. PROTOCOL FOR MANAGEMENT OF STROKE AT

A. BASIC STROKE CARE CENTRE

1. Diagnosis of stroke /Transient Ischemic Attack (TIA) should be made.

Presenting features of stroke

- Sudden numbness or weakness in the face, arm, or leg, especially on one side of the body
- Sudden confusion, trouble speaking, or difficulty understanding speech
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking, dizziness, loss of balance, or lack of coordination
- Impairment or loss of consciousness

Presenting features of TIA (that last less than 24 hours)

- Transient weakness, numbness or paralysis of face, arm or leg, typically on one side of your body
- Transient slurred or garbled speech or difficulty understanding others
- Transient blindness in one or both eyes or double vision
- Curtain like appearance in front of eye (Amaurosis fugax)
- Transient dizziness or loss of balance or coordination

To distinguish from stroke mimics

- Conditions that may cause focal or global symptoms that may mimic stroke symptoms and signs (brain tumors, subdural haemorrhage, epidural haemorrhage, poisoning, symptoms caused by trauma, shock, stokes-adams syndrome, hypertensive encephalopathia, infections like HIV, Tuberculosis and syphilis).
- Care to take proper history of the development of symptoms and further investigations can help in ruling out these conditions.

2. Blood glucose level. Hemogram, Coagulation profile, ECG. should be available 24/7
3. Airway support is recommended for patients with acute stroke with a decreased level of consciousness or compromised airway due to bulbar dysfunction.
4. Oxygen by mask at the rate of 4-6 litres/min should be stared to maintain oxygen saturation of > 94 %.

5. Hypoglycaemia/hyperglycaemia in patients with acute stroke to be treated to achieve normoglycemia
6. Antiplatelet therapy, aspirin (150 mg stat) to be given if CT rules out intracranial haemorrhage (possible only when CT is done), and patient has not been thrombolysed. If within window period for Intravenous thrombolysis (IVT) or mechanical thrombectomy, then it is NOT recommended to give aspirin. Give aspirin after 24 hours of stroke.
7. Routine use of heparin in acute ischemic stroke, including cardioembolic strokes, is NOT recommended.
8. Mild to moderately elevated blood pressure should not be routinely treated in the acute phase of stroke as this may worsen the outcome. A blood pressure level of > 220 /110 mm Hg should be treated with IV labetalol. (see BP protocol in page 80 under regimen for Acute Ischemic Stroke with IV rtPA)
9. If patient is getting IV thrombolysis, blood pressure should be kept below 185/110
10. No drastic lowering of blood pressure in acute ischemic stroke. DO NOT GIVE sublingual nifedipine
11. Intravenous line with normal saline should be started. DO NOT GIVE dextrose containing solutions, except for correcting hypoglycaemia
12. Swallowing assessment should be done prior to oral feeding.
13. Fever in patients with acute stroke should be treated; the temperature should be lowered with antipyretics.
14. Nursing care to prevent pressure sores. Rehabilitation, including passive physiotherapy to be instituted from the first day of the stroke.

B. INDICATIONS FOR REFERRAL TO STROKE CENTRE (PSC)

1. High NIHSS (more than or equal to 5) and if within 24 hours (suitable for IVT or Mechanical thrombectomy)
2. All strokes for CT scan (if not available locally) to diagnose ischemic versus haemorrhagic subtypes. (Mandatory for stroke prevention)
3. A possible candidate for IV thrombolysis. If the patient is a possible case for mechanical thrombectomy as decided in triage, patient should be directed to comprehensive stroke centre with fastest possible secure transport bypassing PSC
4. Altered consciousness
5. Severe headache

6. Uncontrolled seizures
7. Uncontrolled severe hypertension
8. Irregular / laboured breathing
9. Recurrent TIAs
10. Cardio embolic strokes for secondary prevention with anticoagulants and INR monitoring.

C. MANAGEMENT AT STROKE CENTRE (PSC)

1. Identification of acute stroke
2. All patients with acute stroke/ TIA should have a CT scan (plain) immediately and interpreted within 30 minutes
3. Basic investigations, as suggested in Basic Stroke Care Centre, plus platelets and PT/ INR to be done.
4. Thrombolysis protocol where applicable
5. BP protocol where applicable
6. Routine use of corticosteroids, plasma volume expanders, not recommended
7. Treatment as listed in Basic Stroke Care Centre to be followed
8. Swallowing assessment protocol to be applied.
9. Antiplatelet therapy, aspirin (150 mg) should be given immediately for patients with acute ischemic stroke who are not candidates for thrombolytic therapy / mechanical thrombectomy

D. REFERRAL TO COMPREHENSIVE STROKE CENTRE (CSC/HUB)

1. Possible candidate for mechanical thrombectomy as seen clinically along with CT scan/ CT angio findings. Since the procedure should be initiated within 6 hours of onset of stroke, the time estimate should be made accordingly so that patient reaches CSC within 4.5 hours of onset allowing the CSC to reimage the patient and initiate Cath lab procedure.
2. PSC should transfer the patient after injecting the bolus of IV tPA and with infusion running (Drip -n-ship).
3. Large hemispheric infarct on CT with impending herniation with need for decompression hemicraniectomy
4. Large intracerebral haemorrhage requiring surgical treatment
5. Cerebellar strokes in need of surgical intervention

6. A comprehensive evaluation for stroke in young/cardio-embolic strokes/large vessel extracranial disease/ unusual stroke syndromes like arterial dissection, Moya Moya Disease or vasculitis etc., and recurrent strokes

Definition and scope of service for 3 levels of Stroke Care

Program Metrics	Basic Stroke centre	PSC	CSC
Program Director / Team Leader	Sufficient knowledge of cerebrovascular disease, an MBBS or Preferably an MD (Medicine) physician	Sufficient knowledge of cerebrovascular disease (An MD (Medicine) physician / or a Neurologist if available	Neurologist or Stroke-Neurologist with extensive training and experience in Stroke management
Acute Stroke Team	May comprise of a trained physician or Nurse at least 6 hours of stroke education annually.	Available 24/7, at bedside within 15 minutes; at least 8 hours of stroke education annually. May comprise of a trained physician	Available 24/7, at bedside within 15 minutes; at least 8 hours of stroke education annually. Resident or staff physician, trained in acute stroke management
Stroke Unit	No designated beds for acute care of stroke patients	Stroke unit or designated beds for the acute care of stroke patients	Stroke unit + Dedicated neuro intensive care beds for complex stroke patients available 24/7
Initial Assessment of Patient	physician, nurse practitioner, or physician assistant	Emergency Department physician	Emergency Department physician
Diagnostic Testing Capability	Access to basic labs, CT (may not be available within the facility)	CT, labs, CTA, 24/7, and cardiac imaging when necessary (MRI if available but not mandatory)	CT, MRI, labs, CTA, MRA, other cranial and carotid duplex ultrasound, TEE, TTE, catheter angiography 24/7 and cardiac imaging when necessary
Neurologist Accessibility	24/7 via telemedicine	24/7 via in person or telemedicine	Meets concurrently emergent needs of multiple complex stroke patients; Written call schedule for attending physicians providing availability 24/7
Neurosurgical Services	Not available, may need transfer to PSC/CSC	May not be available, may need transfer to CSC	24/7 availability: Neurointerventionalist; Neuroradiologist; Neurologist; Neurosurgeon

Telemedicine	Within 20 minutes of it being necessary	Available	Available
Treatment Capabilities	Airway support, oxygen, correction of blood glucose level, management of blood pressure	IV thrombolytics; may need transfer of patients to CSC for difficult cases or probable endovascular treatment.	IV thrombolytics; Mechanical Thrombectomy, Microsurgical neurovascular clipping of aneurysms; Neuroendovascular coiling of aneurysms; Stenting of extracranial carotid arteries; Carotid endarterectomy; Endovascular therapy
Transfer protocols	With one PSC or CSC	For neurointervention or Neurosurgical procedure	Receiving transfers, may tranfer back to PSC or ASRH for continuation of treatment after stabilising the patient to reduce the load of stroke service
Staff Education Requirements	minimum of twice a year	minimum of twice a year	Nurses and other ED staff - 4 hours annually; Stroke nurses - 8 hours annually
Provision of Educational Opportunities	Provides educational opportunities to primary health care workers and ambulance personnel	Provides educational opportunities to emergency and ambulance personnel; Provides at least 2 stroke education activities per year to public	Provides educational opportunities to emergency and ambulance personnel; Provides at least 2 stroke education activities per year to public
Clinical Performance Measures	Non-Standardized Measures: Organization chooses 4 measures, at least 2 are clinical measures related to clinical practice guidelines	Standardized Measures: core stroke measures	Standardized Measures: core stroke measures and comprehensive stroke measures
Research	N/A	N/A	Participates in patient-centred research that is approved by the Institutional Review Board
Annual review standard	One Reviewer, One Day	One Reviewer, One Day	Two Reviewers, Two Days

Adopted and modified from American Stroke Association (38)

In the Indian context the role of different Stroke Centres can be sub served by

1. **Basic Stroke Centre** – All hospitals / health facilities can be equipped and trained to meet these criteria.

2. **Primary Stroke Centre (PSC)-** All District level hospitals and all Medical College and hospitals (without a Neurosurgery and Neurointervention facility) can serve as PSC. Any Multispeciality Private Hospital with the requisite infrastructure can also serve as PSC
3. **Comprehensive Stroke Centre (CSC)-**Medical colleges and postgraduate teaching hospitals with neurology, neurosurgery and neurointervention facilty 24/7 with the requisite infrastructure will serve as CSC. Amy private multispeciality institute with the above mentioned criteria also can be designated as CSC.

2. PROTOCOL FOR IV THROMBOLYSIS FOR ACUTE ISCHEMIC STROKE (AIS)

Inclusion Criteria (Must be all 'YES')

1. Age >=18 years – 80 years
2. A significant neurologic deficit expected to result in long term disability
3. Non-contrast CT scan showing no hemorrhage or well-established large infarct acute ischemic stroke symptoms with onset (last known well) clearly defined, less than 4.5 hours before thrombolysis will be given
4. Consent form/Risks/Benefits: Discussed and documented in the medical record.

Exclusion Criteria

Contraindications include any of the following

1. Current intracranial or subarachnoid hemorrhage
2. CT demonstrates multilobar infarction (hypodensity>1/3 cerebral hemisphere)
3. Recent (within 3 months) intracranial or intraspinal surgery/ serious head trauma/prior stroke
4. Severe uncontrolled hypertension (>185/110mm Hg)
5. Presence of intracranial conditions that may increase the risk of bleeding (vascular neoplasms, arteriovenous malformations or aneurysm)
6. Active internal bleeding
7. Bleeding diathesis including but not limited to platelet < 100 000/mm; current use of oral anticoagulant with INR>1.7; PT>15 seconds, current use of direct thrombin inhibitors or direct factor Xa inhibitors with sensitive lab tests, administration of heparin within 48 hours with elevated aPTT, administration of LMWH in 24 hours

Thrombolysis should not be delayed by coagulation testing unless there is a history of coagulopathy and history of current anticoagulation intake

Warnings

These conditions may increase risk of unfavourable outcomes but are not necessarily a contraindication to treatment-

1. Glucose less than 50 mg/dl or greater than 400mg/dl *(If presenting neurological symptoms appear not to be due to ischemia, treatment for correcting glucose level* may *be given)*
2. Seizures at onset of stroke if residual deficits are due to post-ictal state rather than due to ischemia. If rapid diagnosis of vascular occlusion can be made, treatment may be given.
3. Only minor or rapidly improving stroke symptoms
4. Hypertension - systolic blood pressure >175 mm Hg and diastolic blood pressure > 110 mm Hg
5. Recent major surgery or procedures (e.g. coronary artery bypass graft, obstetrical delivery, organ biopsy, previous puncture of non-compressible vessels), particularly within 14 days
6. Recent gastrointestinal or genitourinary bleeding (within 3 weeks)
7. H/o recent intracranial hemorrhage
8. Recent h/o serious trauma
9. Recent myocardial infarction (within 3 months)
10. High likelihood of left heart thrombus (eg, Mitral stenosis with atrial fibrillation)
11. Acute pericarditis / subacute bacterial endocarditis (SBE)
12. Diabetic hemorrhagic retinopathy or other hemorrhagic ophthalmic conditions
13. Septic thrombophlebitis or occluded AV cannula at seriously infected site
14. Hemostatic defects including those secondary to severe hepatic or renal disease
15. Any other condition in which bleeding constitutes a significant hazard / would be particularly difficult to manage because of its location.
16. Severe hepatic dysfunction
17. Renal dysfunction due to any cause including dehydration
18. Prior hypersensitivity to tissue plasminogen activator
19. Advanced age>90 years

20. Pregnancy
21. Lactating woman
22. Patient on GpIIb-IIIa inhibitors

The regimen for treatment of acute ischemic stroke with IV rtPA

1. Infuse ALTEPLASE 0.9 mg/ kg (maximum of 90 mg) over 60 minutes with 10% of the dose given as a bolus dose over 1 minute) and rest of the dose as an unfusion over 60 mins / Or TENECTEPLASE at a dose of 0.20 mg/Kg body weight for a maximum dose of 20 mg IV bolus.
2. Admit the patient to Intensive Care Unit (ICU) or a stroke unit for monitoring.
3. Perform neurological assessments every 15 minutes during the infusion of rt PA and every 30 minutes for the next 6 hours and then every hour until 24 hours from treatment.
4. If the patient develops a severe headache, acute hypertension, nausea or vomiting, discontinue the infusion (if the agent is still being administered), and obtain a CT scan of the brain on an emergent basis.
5. Measure blood pressure every 15 minutes for the first 2 hours, every 30 mins for the next 6 hrs & then every hour until 24 hours from treatment.
6. Administer antihypertensive medications to maintain blood pressure at or below these levels. (below 185/110)
7. If diastolic BP 105 – 120 mmHg or systolic BP is 180 – 230 mmHg, intravenously administer 10 mg labetalol over 1 – 2 minutes. May repeat or double the dosage or labetalol every 10 to 20 minutes to a maximum dose of 300 mg. As an alternative, can start with the initial bolus dose of labetalol (20 mg) and then follow with a continuous labetalol infusion given at a rate of 2 – 8 mg/min.
8. If diastolic BP 121-140 mm Hg or systolic blood pressure > 230mm Hg. Intravenously administer 10 mg labetalol over 1-2 minutes. May repeat or double labetalol every 10 minutes to a maximum dose of 300 mg. As an alternative, can start with the initial bolus dose of labetalol and then follow with a continuous labetalol infusion given at a rate of 2 – 8 mg/ min. If the blood pressure is not controlled, consider starting infusion of sodium nitroprusside.
9. If diastolic blood pressure > 140 mmHg, start infusion of sodium nitroprusside at a rate of 0.5 mg/kg/min with close hemodynamic monitoring

10. Delay placement of Nasogastric tubes, indwelling bladder catheters, or intra-arterial pressure catheters during first 24 hours

Intravenous rtPA (0.9 mg/kg, maximum dose of 90 mg) is strongly recommended for carefully selected patients who can be treated within 3 hours of the onset of ischemic stroke and carries a Grade I- A recommendation (for rtPA under 4.5 hours, it's a Grade I, B-R). Intravenous administration of rtPA (Alteplase/ Actilyse) is currently the only approved therapy for the treatment of patients with acute ischemic stroke. Earlier treatment (within 90 minutes) may be more likely to result in a favourable outcome. Treatment with rtPA is associated with a risk of symptomatic intracranial haemorrhage in 1.6 % to 3.8% as per different studies. Close observation and monitoring of the patient and early management of arterial hypertension are critical. The use of anticoagulants and antiplatelet agents should be delayed for 24 hours after treatment. Once post thrombolysis brain imaging excludes any bleed.

Dose of rtPA (Alteplase)	0.9 mg/Kg: (Max 90mg), 10% Bolus over 1 minute 90% infusion over 60 minutes
Dose of TENCETEPLASE	0.20 Mg/Kg: IV bolus (Max 20 mg)
DO NOT GIVE	Aspirin/heparin/warfare/clopidogrel or other antithrombotic drugs within 24 hours of thrombolysis

National Institute of Health Stroke Scale (NIHSS)

NIHSS or Stroke Severity score provides the information regarding the severity of stroke and is recorded at hospital admission. It serves as a measure of improvement for follow-up. Total NIHSS score from 0-42 is recorded by adding up the individual scores.

Tested item	Response	Scores
1A	Level of consciousness	0 - Alert
		1 - Drowsy
		2 - Obtunded
		3 - Coma/unresponsive
1B	Orientation questions (2)	0 - Answers both correctly
		1 - Answers 1 correctly
		2 - Answers neither correctly
1C	Response to commands (2)	0 - Performs both tasks correctly
		1 - Performs 1 task correctly
		2 - Performs neither
2	Gaze	0 - Normal horizontal movements
		1 - Partial gaze palsy
		2 - Complete gaze palsy
3	Visual fields	0 - No visual field defect
		1 - Partial hemianopia
		2 - Complete hemianopia

		3 - Bilateral hemianopia
		0 - No visual field defect
4	Facial involvement	0 - Normal
		1 - Minor facial weakness
		2 - Partial facial weakness
		3 - Complete unilateral palsy
5	Motor function (arm)	0 - No drift
	a. left	1 - Drift before 10 s
	b. right	2 - Falls before 10 s
		3 - No effort against gravity
		4 - No movement
6	Motor function (leg)	0 - No drift
	a. Left	1 - Drift before 5 s
	b. Right	2 - Falls before 5 s
		3 - No effort against gravity
		4 - No movement
7	Limb ataxia	0 - No ataxia
		1 - Ataxia in 1 limb
		2 - Ataxia in 2 limbs
8	Sensory	0 - No sensory loss
		1 - Mild sensory loss
		2 - Severe sensory loss
9	Language	0 - Normal
		1 - Mild aphasia
		2 - Severe aphasia
		3 - Mute or global aphasia
10	Articulation	0 - Normal
		1 - Mild dysarthria
		2 - Severe dysarthria
11	Extinction/ Inattention	0 - Absent
		1 - Mild loss (1 sensory modality lost)
		2 - Severe loss (2 modalities lost)

Modified Rankin scale

The modified Rankin Scale (mRS) is used to measure the degree of disability in patients who have had a stroke. It gives an estimate of the functional status of the patient and the supervision needed. It is recorded at the time of admission to the hospital (provides the status of the subject prior to occurrence of current episode of stroke), at discharge and at 28 days and 3 months follow-up. It is a clinician-reported measure and pre-stroke MRS can also be collected from history from patient's relatives.

Modified Rankin scale	
Symptoms Score	
a) Patient doesn't have any symptoms?	0
b) Patient is able to carry out all usual duties and activities without any assistance?	1
c) Patient can look after own affairs without assistance?	2

d) Patient requires some assistance in doing activities and can walk by himself or herself without any support?	3
e) Patient needs assistance for walking and attending own needs?	4
f) Patient is bedridden/incontinent and requires constant care?	5
g) Is the patient dead?	6

Barthel Index

Barthel Index is an ordinal scale (100-point rating scale) used to measure performance in activities of daily living (ADL). It measures the degree of assistance required by an individual on 10 items of mobility and self-care, a higher number is a reflection of greater ability to function independently following hospital discharge.

Index item	Score	Description
Chair/bed transfers	0	Unable to participate in a transfer. Two attendants are required to transfer the patient with or without a mechanical device
	3	Able to participate but maximum assistance of one other person is require in all aspects of the transfer
	8	The transfer requires the assistance of one other person. Assistance may be required in any aspect of the transfer
	12	The presence of another person is required either as a confidence measure, or to provide supervision for safety
	15	The patient can safely approach the bed walking or in a wheelchair, lock brakes, lift footrests, or position walking aid, move safely to bed. Lie down, come to a sitting position on the side of the bed, change the position of the wheelchair, transfer back into it safely and/or grasp aid and stand the patient must be independent in all phases of this activity
Ambulation	0	Dependent in ambulation
	3	Constant presence of one or more assistance is required during ambulation
	8	Assistance is required with reaching aids and/ or their manipulation. One person is required to offer assistance
	12	The patient is independent in ambulation but unable to walk 50 meters without help, or supervision is needed for confidence or safety in hazardous situations.
	15	The patient must be able to wear braces if required, lock and unlock these braces assume standing position, sit down, and place the necessary aids into position for use. The patient must be able to crutches, canes or a walk arette, and walk 50 metres without help or supervision
Ambulation / Wheelchair *(if unable to walk)*	0	Dependent in wheelchair ambulation
	1	Patient can propel self-short distances on flat surface, but assistance is required for all other steps of wheelchair management

Only use this item if the patient is rated "0" for ambulation, and then only if the patent has been trained in wheelchair management	3	Presence of one person is necessary and constant assistance is required to manipulate chair to table, bed etc
	4	The patient can propel self for a reasonable duration over regularly encountered terrain. Minimal assistance may still be required in tight corners or to negotiate a kerb 100mm high
	5	To propel wheelchair independently, the patient must be able to go around corners, turn around, manoeuvre the chair to a table, bed, toilet, etc. the patient must be able to push a chair at least 50 metres and negotiate a kerb
Stair climbing	0	The patient is unable to climb stairs
	2	Assistance is required in all aspects of chair climbing, including assistance with walking aids
	5	The patient is able to ascend/ descend but is unable to carry walking aids and needs supervision an assistance
	8	Generally, no assistance is required. At times supervision is required for safety due to morning stiffness, shortness of breath etc
	10	The patient is able to go up and down a flight of stairs safely without help or supervision. The patient is able to use hand rails, cane or crutches when needed and is able to carry these devices as he/she ascends or descends
Toilet transfers	0	Fully dependent in toileting
	2	Assistance required in all aspects of toileting
	5	Assistance may be required with management of clothing, transferring or washing hands
	8	Supervision may be required for safety with normal toilet. A commode may be used at night but assistance is required for emptying and cleaning
	10	The patient is able to get on/off the toilet. Fasten clothing and use toilet paper without help. If necessary the patient may use a bed pan or commode or urinal at night, but must be able to empty it and clean it
Bowel control	0	The patient is bowel incontinent
	2	The patient needs help to assume appropriate position and with bowel movement facilitatory techniques
	5	The patient can assume appropriate position, but cannot use facilitatory techniques or clean self without assistance and has frequent accidents. Assistance is required with incontinence aid such as pad etc
	8	The patient may require supervision with the use of suppository or enema and has occasional accidents
	10	The patient can control bowels and has no accidents, can use suppository, or take an enema when necessary
Bladder control	0	The patient is dependent in bladder management is incontinent or has indwelling catheter
	2	The patient is incontinent but is able to assist with the application of an internal or external device

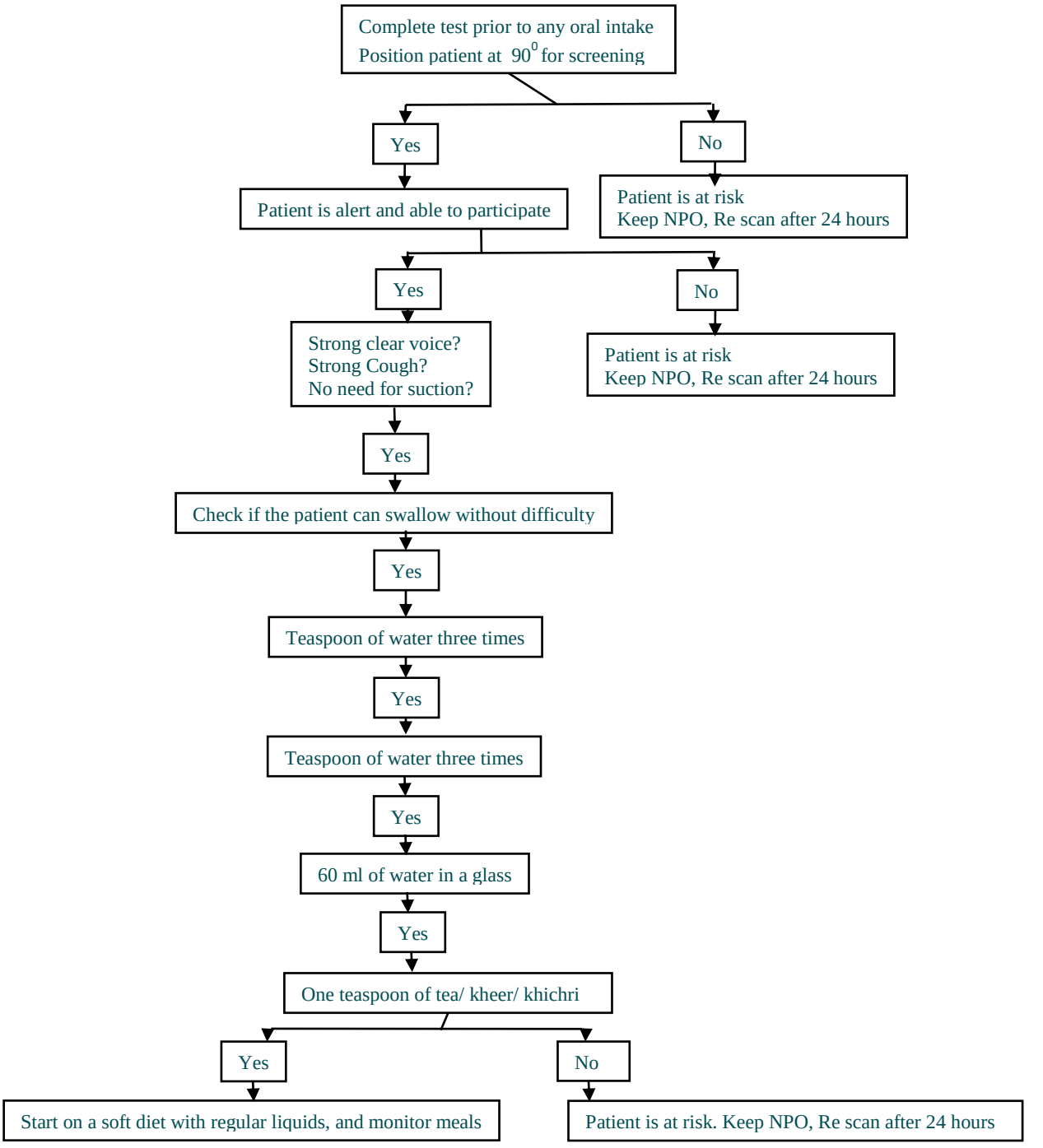
	5	The patient is generally dry by day, but not at night and needs some assistance with the devices
	8	The patient is generally dry by day and night, but may have an occasional accident or need minimal assistance with internal or external devices
	10	The patient is able to control bladder day and night, and/or is independent with internal or external device
Bathing	0	Total dependence in bathing self
	1	Assistance is required in all aspects of bathing, but patient is able to make some contribution
	3	Assistance is required with either transfer to shower/bath or with washing or drying including inability to complete a task because of condition or disease etc
	4	Supervision is required for safety in adjusting the water temperature or in the transfer
	5	The patient may use a bathtub a shower or take a complete sponge bath. 0the patient must be able to do all the steps of whichever method is employed without another person being present
Dressing	0	The patient is dependent in all aspects of dressing and is unable to participate in the activity
	2	The patient is able to participate to some degree, but is dependent in all aspects of dressing
	5	Assistance is needed in putting on and or removing any clothing
	8	Only minimum assistance is required with fastening clothing such as buttons, zips, bra, shoes etc
	10	The patient s bale to put on remove corset, braces, as prescribed
Personal hygiene (Grooming)	0	The patient is unable to attend to personal hygiene and is dependent in all aspects
	1	Assistance is required in all steps of personal hygiene, but patient able to make some contribution
	3	Some assistance is required in one or more steps of personal hygiene
	4	Patient is able to conduct his/her own personal hygiene but requires minimal assistance before and or/ after the operation
	5	The patient can wash his/her hands and face. Comb hair, clean teeth and shave. A male patient may use any kind of razor but must insert the blade, or plug in the razor without help, as well as retrieve it from the drawer or cabinet. A female patient must apply her own make-up, if used but need not braid or style her hair
Feeding	0	Dependent in all aspects and needs to be fed, nasogastric needs to be administered

	2	Can manipulate an eating device, usually a spoon, but someone must provide active assistance during the meal
	5	Able to feed self with supervision. Assistance is required with associated tasks such as putting milk/sugar into tea, salt pepper, spreading butter, turning a plate or other set up activities
	8	Independence in feeding with prepared tray, expect may need meat cut, milk carton opened or jar lid etc. the presence of another person is not required
	10	The patient can feel self from a tray or table when someone puts the food within reach. The patient must put on an assistive device if needed cut food and if desired use salt and pepper, spread butter etc

Score	Interpretation
00 - 20	Total dependence
21 - 60	Severe dependence
61 - 90	Moderate dependence
91 - 99	Slight dependence
- 100	Independence

Score	Prediction
Less than 40	Unlikely to go home - Dependent in mobility - Dependent in self care
60	Pivotal score where patients move from dependency to assisted independence
60 - 80	If living alone will probably need a number of community services to cope
More than 85	Likely to be discharged to community living - Independent in transfers and able to walk or use wheelchair independently

3. PROTOCOL FOR SWALLOWING TEST



Signs of a patient having difficulty in swallowing:

1. Gurgly, wet sounding voice
2. Coughing while swallowing
3. Leftover food in the mouth

If NPO for three days and more: Start non-oral feeds such as nasogastric tube feeding.

4. ESSENTIAL ELEMENTS TO DESIGNATE A STROKE CENTRE

Patient care services	Support services
Acute stroke team Written care protocols Emergency medical services Stroke Unit (could be in ICU)	Commitment, support of Head of the Institute Neuroimaging services, Cath Lab Lab. Services

Patient Care Services

A. Acute Stroke Team

1. Multidisciplinary personnel with expertise in diagnosing and treating stroke- may include stroke physician/emergency physician / neurologist (will include the roster of emergency physician personnel)
2. The minimum team should include a stroke physician and another healthcare provider (stroke nurse, etc.)
3. Someone from the team should be available 24/7
4. The team should have a logbook to track response times, diagnosis, treatments and outcomes of stroke.

B. Written Care Protocols

1. Designed, adapted and utilized by the team; should include use of written protocols for patients eligible to receive IV rtPA treatment and other acute therapies such as stabilization of vital functions and management of blood pressure in the emergency department.
2. Protocols should also provide information regarding initial diagnostic tests and initial use of medications.
3. Should be reviewed/updated at least once per year.

C. Emergency Medical Services

1. A collaborative relationship between ICU which will serve as stroke units and emergency medical services personnel must be integrated to improve services and reduce transport delays.
2. Calls for possible stroke should be assigned high priority for evaluation and transport.
3. Educational activities should be offered at least twice a year.

D. Emergency Department (ED) Physicians/Nurses/etc.

1. Personnel should be trained to diagnose and initiate treatment of acute strokes.
2. Personnel should know about stroke team and its role.
3. ED should document performance measures such as time from symptom onset to treatment.

4. Training for ED should occur at least twice a year to update them about stroke diagnosis and treatment.

E. Stroke Unit

1. Geographically distinct space that can be within ED or ICU or medical or neurological ward, which must provide continuous telemetry monitoring, written care protocols and BP monitoring at all times
2. Personnel should have expertise in managing stroke
3. Should have clear admission and transfer policy

Support Services

A. Neuroimaging service

1. CT scan
2. Available 24/7
3. Completed within 15 minutes of being ordered
4. Evaluation within 15 minutes.

B. Laboratory Services

1. Emergency blood urea/creatinine/PT/INR/Platelet count/Hemoglobin/Serum Na/K
2. Available 24/7
3. Completed within 15-30 minutes of being ordered

C. Essential Equipment in Emergency Department

1. Pulse Oximetry
2. Glucometer
3. BP instrument
4. ECG

D. Essential medication in Emergency Department specifically for stroke

1. Recombinant Tissue Plasminogen Activator (rTPA) – 50 mg/20 mg vials – 2
2. InjectionV Labetalol (10 mg)
3. Injection Enalaprilat
4. Injection Ranitidine
5. Injection Hydrocortisone
6. Inj Avil
7. Injection Lasix
8. Injection Levetiracetum / Fosphenytoin or Phenytoin / Injection Lorazepam 4 mg