Institution Name: Diwan of Royal Court in Collaboration with MoH

Document Title: Acute Stroke Management Protocols

Approval Process

	Name	Title	Institution	Date	Signature
Written by	Task force	Task force	Multisectoral Task force	28-January-2020	As per attached list
Reviewed by	Dr. Salim Bin Shtait Al-Ghannami	Director General of Medical Services	Diwan of Royal Court		
Validated by	Dr. Qamra Bint Said Al-Sariri	DG of QAC	Ministry of Health		
Approved by	Dr. Kadhim Bin Jaffar Al-Lawati	DG of MSC	Ministry of Health	15/4/2020	

Task Force Members

Dr. Arunodaya Gujjar,
Senior consultant Neurology,
SQUH, Oman

Dr. Ammar Al-Kashmiri, MD, FRCP(C), FACEP
Senior Consultant Emergency Physician | Emergency Department | Directorate General Khoula Hospital
Associate Program Director | Emergency Medicine Residency | Oman Medical Specialty Board
Senior Clinical Lecturer | College of Medicine & Health Sciences | Sultan Qaboos University
Chairman | EM Clinical Services Development Committee | Ministry of Health

Dr. Qasim Al Hinai, BScH, MD, MRCSI (Ireland), FRCS (Neurosurgery-Canada)
Senior consultant neurosurgeon, department of neurosurgery,
Directorate General Khoula Hospital, Muscat, Oman.

Dr. Abdulla Al-Salti, MD, MRCP (UK), FRCPC, CSCN
Senior Consultant,
Head of Neurology Department, Directorate of Neuroscience
Directorate General Khoula Hospital, Oman

Dr. Ahmed Al-Habsi, MD, FRCR
Cosultant Interventional Neuroradiology
Directorate General Khoula Hospital, Oman

Dr. Salim Al Abri, MD
Specialist Neurosurgery
Royal Court Affairs, Specialist Neurosurgery, Directorate General Khoula Hospital

Dr. Salim Al-Mughairi, MBBS, FRCR, EDiNR,
Neuroradiologist,
Medical Services of the Royal Court of Oman.

Mr. Yousuf Al-Hasani, GND,RN, BNs, MRes, MSC
PhD candidate, UCLA
Senior Nurse Specialist A (Administration)
Head of Department, External Clinics

Content Table:

Executive Summary

Stroke is one of the leading causes of morbidity and mortality in Oman. The medical care provided to patients afflicted by stroke is variable from one health setting to another. Therefore, there was a perceived need to standardize the care provided to stroke patients and ensure their management is up to date and matches current evidence. This would subsequently provide these patients with the best possible outcome and limit their resultant disability.

The enclosed protocols address the management of patients presenting with acute stroke. They have been reviewed by international and national experts and they aim to serve as a guideline for all healthcare practitioners and administrators in managing and supporting the care for stroke patients. In the process of writing these protocols, team members took into consideration the current situation and resources availability in the national health system in Oman.

Health care disciplines are dynamic and on a continuous improvement through evidence-based practices. The team members have reviewed most prominent updated published related protocols and articles till April 2018. The protocols will require continuous monitoring and audit checks to ensure that the protocols are kept updated with the latest evidence available and that practitioners are up-to-date.

We hope that these protocols are embraced and followed to safeguard our patients.

Dr. Salim Bin Shtait Al-Ghannami
Director General of Medical Services, Diwan of Royal Court
Head of team, Stroke Management Units Project

Disclaimer

This document was developed by a national Stroke Protocol Taskforce to outline the main management responsibilities of acute stroke patients presenting to healthcare institutions of all levels across Oman.

The information presented is only intended for clinical guidance of health care providers. It should not replace the treating physician's judgment.

Abbreviations

ACA	Anterior cerebral artery
ANA	Antinuclear Antibodies
ANCA	Antineutrophil Cytoplasmic Antibodies
aPTT	Activated Partial Thromboplastin Time
ASA	Acetylsalicylic Acid (Aspirin)
ASU	Acute stroke unit
AV	Arteriovenous
B2M	Beta-2 Microglobulin
BID	Bis In Die (twice daily)
BP	Blood Pressure
CBC	Complete Blood Count
CPP	Cerebral Perfusion Pressure
CBV	Cerebral Blood Volume
CME	Continuing Medical Education
CNS	Central nervous system
CRP	C-reactive protein
CSF	Cerebrospinal fluid
CT	Computed Tomography
CTA	Computed Tomography Angiography
CTV	Computed Tomography venography
CVT	Cerebral Venous Thrombosis
CXR	Chest X-ray

DC	Decompressive Craniectomy
DVT	Deep Vein Thrombosis
ED	Emergency Department
ECG	Electrocardiogram
EMS	Emergency Medical Services
ENT	Ear, Nose and Throat
ESR	Erythrocyte Segmentation Rate
FFP	Fresh Frozen Plasma
GCS	Glasgow Coma Scale
Hb	Hemoglobin
HD / HDU	High Dependency Unit
HTN	Hypertension
ICA	Internal Carotid Artery
ICH	Intracranial Hemorrhage
ICU	Intensive Care Unit
ICP	Intracranial pressure
IM	Intramuscular
INR	International Normalized Ratio
IV	Intravenous
IVH	Intraventricular Hemorrhage
LMWH	Low Molecular Weight Heparin
MCA	Middle Cerebral Artery
MRA	Magnetic Resonance Angiography
MRI	Magnetic Resonance Imaging
MRV	Magnetic Resonance Venography

MT	Mechanical Thrombectomy
Na	Sodium
NGT	Nasogastric Tube
NIHSS	National Institute of Health And Stroke Scale
NOACs	Novel Oral Anticoagulants
NPO	Nil Per Oral
OD	Once Daily
PCA	Posterior Cortical Atrophy
PCC	Prothrombin Complex Concentrate
pCO2	Partial Pressure Of Carbon Dioxide
PICA	Posterior Inferior Cerebellar Artery
PT/PTT	Prothrombin/ Partial Thromboplastin Time
QID	*Quater In Die* (4 Times A Day)
ROSIER	Recognition Of Stroke In The Emergency Room
RFT	Renal Function Test
rt-PA	Recombinant Tissue Plasminogen Activator
SC	Subcutaneous
STEMI	ST Elevation Myocardial Infarction
STAT	*Statum* (Immediately)
TEE	Transesophageal Echocardiography
TIA	Transient Ischemic Attack
TID	*Ter In Die* (3 Times A Day)
U	Units

Definitions

Ischemic Stroke

An acute episode of neurological dysfunction caused by focal cerebral, spinal, or retinal infarction.

Intracerebral Hemorrhage (ICH)

A focal collection of blood within the brain parenchyma or ventricular system that is not caused by trauma.

Stroke caused by Intracerebral Hemorrhage

Rapidly developing clinical signs of neurological dysfunction attributable to a focal collection of blood within the brain parenchyma or ventricular system that is not caused by trauma.

Stroke caused by Cerebral Venous Thrombosis

Infarction or hemorrhage in the brain, spinal cord, or retina because of thrombosis of a cerebral venous structure. Symptoms or signs caused by reversible edema without infarction or hemorrhage do not qualify as stroke.

Transient Ischemic Attack (TIA)

A transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia without infarction.

Thrombolytic/Fibrinolytic Therapy

The administration of a drug agent that converts plasminogen to the natural fibrinolytic agent Plasmin. Plasmin lyses clots by breaking down the fibrinogen and fibrin contained in a clot and potentially restore vascular flow.

Mechanical Thrombectomy

The removal of a thrombus from a blood vessel, performed as an emergency interventional endovascular procedure to restore cerebral circulation using stent retrieval or aspiration technique.

Hyperacute Stroke Care

The interventions involved in the assessment, and management in the early hours after ischemic stroke onset. This includes thrombolysis or endovascular interventions and emergency neurosurgical procedures.

Acute Stroke Care

The interventions involved in the assessment and management, and early recovery in the first days after stroke onset. The aims are to identify the nature and mechanism of stroke, prevent further stroke complications, promote early recovery, and provide palliation or end-of-life care.

Stroke Rehabilitation

A progressive, dynamic, goal orientated process aimed at enabling a patient with neurological impairment to reach their optimal physical, cognitive, emotional, communicative and/or social functional level.

Decompressive Craniectomy

A surgical technique used to relieve the increased intracranial pressure and brain tissue shifts that occur in the setting of large cerebral hemisphere mass, or space-occupying lesions or massive cerebral infarction (malignant MCA territory infarction).

Stroke Unit

An organized in-hospital facility that is devoted to care for patients with stroke, staffed by a multidisciplinary team with special expertise in stroke care.

Introduction

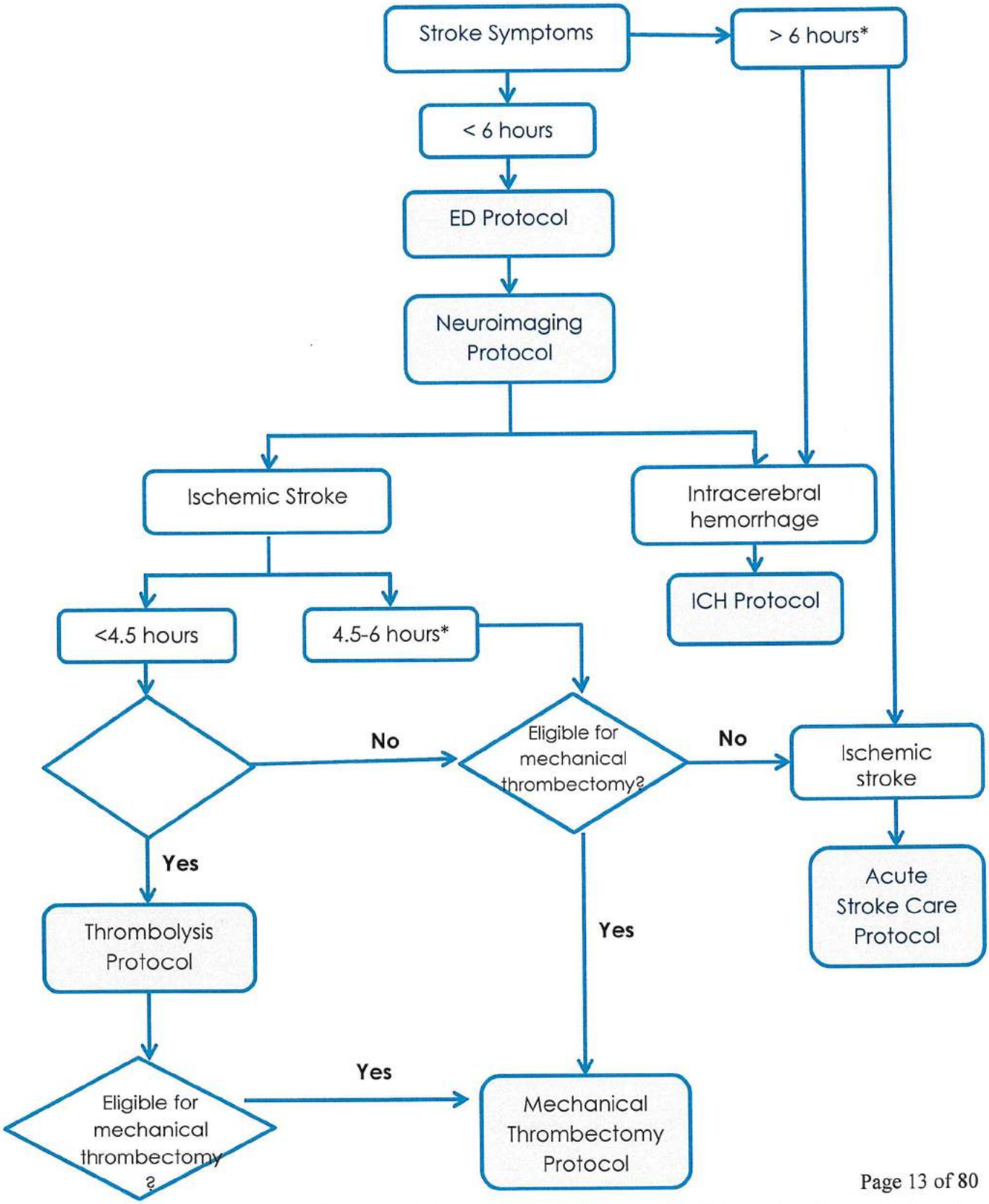
All stroke patients should be managed as a time critical emergency. Standardization of management is essential in order to ensure universal care and the best possible outcomes for affected patients. The protocols enclosed within this document target healthcare institutions and focuses on care that is required from the time of initial hospital presentation. They aim to provide standardized management and promote a platform for inter-hospital collaboration. The protocols mainly follow algorithms that start from arrival at the emergency department until the final disposition from hospital.

The document includes the following protocols:

- Emergency Department Protocol
- Neuroimaging Protocol
- Thrombolysis Protocol
- Mechanical Thrombectomy Protocol
- Intracerebral Hemorrhage Protocol
- Acute Ischemic Stroke Protocol
- In-hospital Stroke Protocol
- Inter-Facility Transfer Protocol
- Stroke Rehabilitation Protocol

The following algorithm on page 13 describes the flow of the protocols.

General Acute Stroke Management Protocols Algorithm



*For certain stroke situations > 6-24 hours, refer to Mechanical Thrombectomy Protocol

Emergency Department Protocol

1. At Triage

1.1. A patient presenting with any of the following symptoms should be considered having a potential stroke:

1.1.1. Sudden numbness or weakness of the face, arm or leg, especially on one side of the body

1.1.2. Sudden confusion, trouble speaking or understanding

1.1.3. Sudden trouble seeing in one or both eyes

1.1.4. Sudden trouble walking, dizziness, loss of balance or coordination

1.1.5. Sudden, severe headache with no known cause

*Patients should initially undergo an immediate finger prick blood glucose level testing. Readings < 3.5 mmol/l should be urgently corrected to normal prior to proceeding with ED Stroke Protocol

1.2. The Triage Nurse / Doctor must immediately determine the timing of symptoms onset (if stroke onset time is unknown, presume < 4.5 hours).

1.3. The Triage Nurse / Doctor should apply the "Recognition of Stroke in the Emergency Room" scale (ROSIER) –see Appendix I

1.4. Patients are deemed potentially eligible for acute reperfusion treatment if:

1.4.1. ROSIER Scale of ≥ +1 (or stroke is suspected on other clinical grounds)

1.4.2. Timing of symptoms onset is ≤ 6 hours

1.4.3. The patient must be triaged as "Category 2" (according to national triage system) at a minimum

1.4.4. The senior ED doctor must be immediately notified and the patient transferred to a resuscitation bed

2. At the Resuscitation Area

The senior Emergency Department Doctor and Nurse must perform the following:

2.1. Immediate evaluation and stabilization of airway, breathing, and circulation.

2.2. Rapid assessment to confirm stroke and exclude stroke mimics.

2.3. Confirmation of eligibility for reperfusion therapy after ruling in stroke.

2.4. If the patient is confirmed to be eligible then Code Stroke should be immediately activated (If no response within 5 minutes contact the Internal Medicine physician, Stroke specialist or Neurology on call directly).

2.4.1. Assessment should include heart rate and rhythm, blood pressure, temperature, oxygen saturation, hydration status, and presence of seizure activity.

2.4.2. Oxygen supplementation (Target oxygen saturation > 94%).

2.4.3. Ensure emergent CT brain scan arranged.

2.4.4. Insert large bore IV (minimum 18 Gauge) in each cubital vein (two required).

2.4.5. Venesection and arrange URGENT bloods: Complete blood count (CBC), renal function test, Glucose, Liver function test, Coagulation profile, Troponin.

2.4.6. A 12 lead ECG (should not delay CT scan).

2.4.7. Document estimated weight.

3. Code Stroke

The protocol recommends that a code stroke team is available 24/7 and that a roster of providers is available to relevant hospital staff. The following are included in the code stroke activation:

3.1. Neurology on-call: should call back the ED and rush to the ED immediately.

3.2. CT technologist: Should call ED for the patient immediately to the CT room.

3.3. Radiology on-call: Should rush to CT room immediately

3.4. ED nurse in-charge: Should rush to the Resuscitation Area.

3.5. Stroke nurse: Should call back and rush to the ED.

3.6. Bed manager: Should call back ED and arrange a bed.

4. Target Times

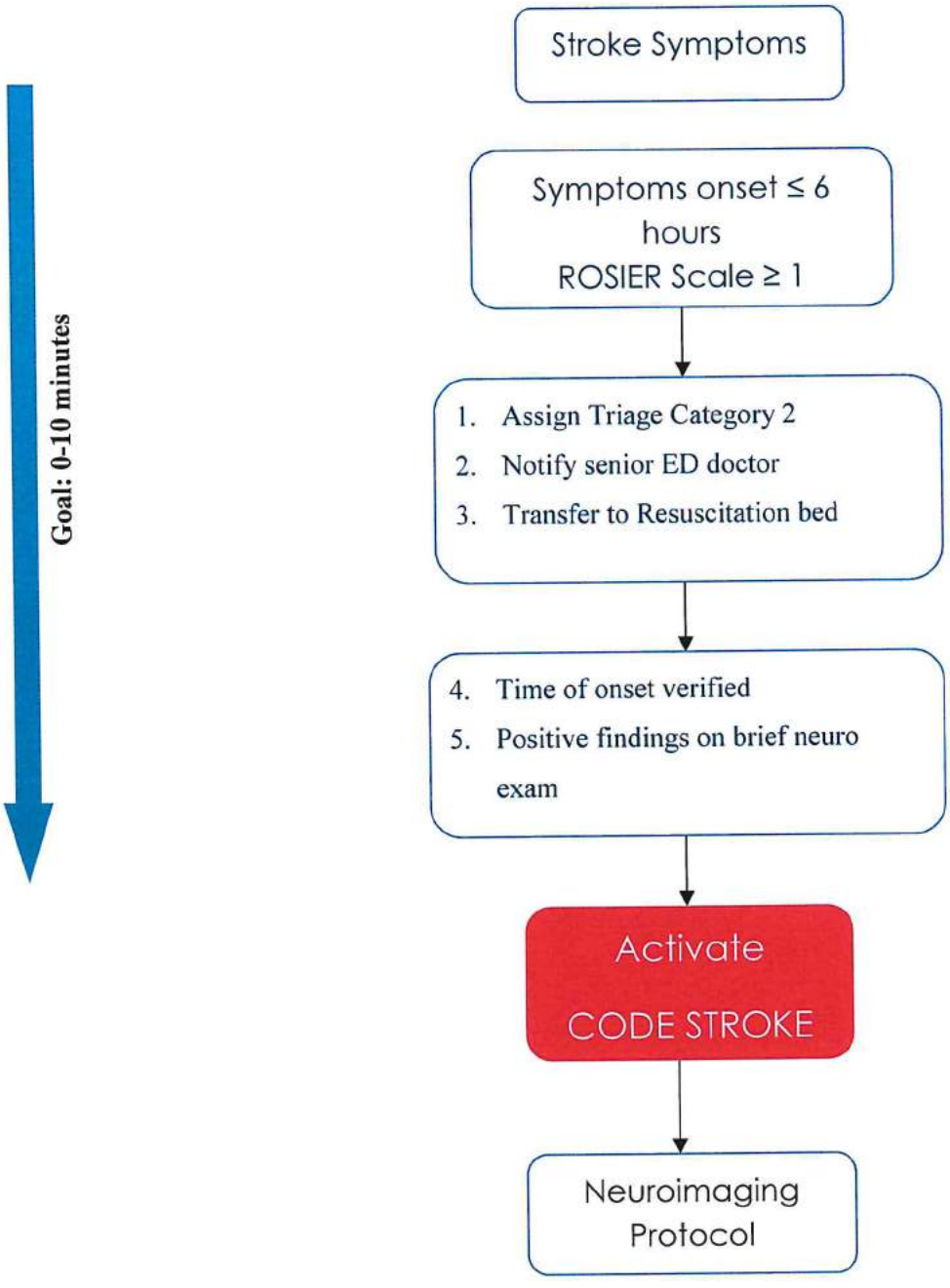
4.1. Target Initial medical assessment to be completed in the first 10 minutes

4.2. Target Door – Brain CT < 25 minutes

4.3. Target Door – needle < 45 min (for IV thrombolysis)

4.4. Target Door – femoral puncture < 60 min (for Mechanical Thrombectomy – if eligible)

Emergency Department Acute Ischemic Stroke Algorithm



Emergency Doctor & Nurse Responsibilities:

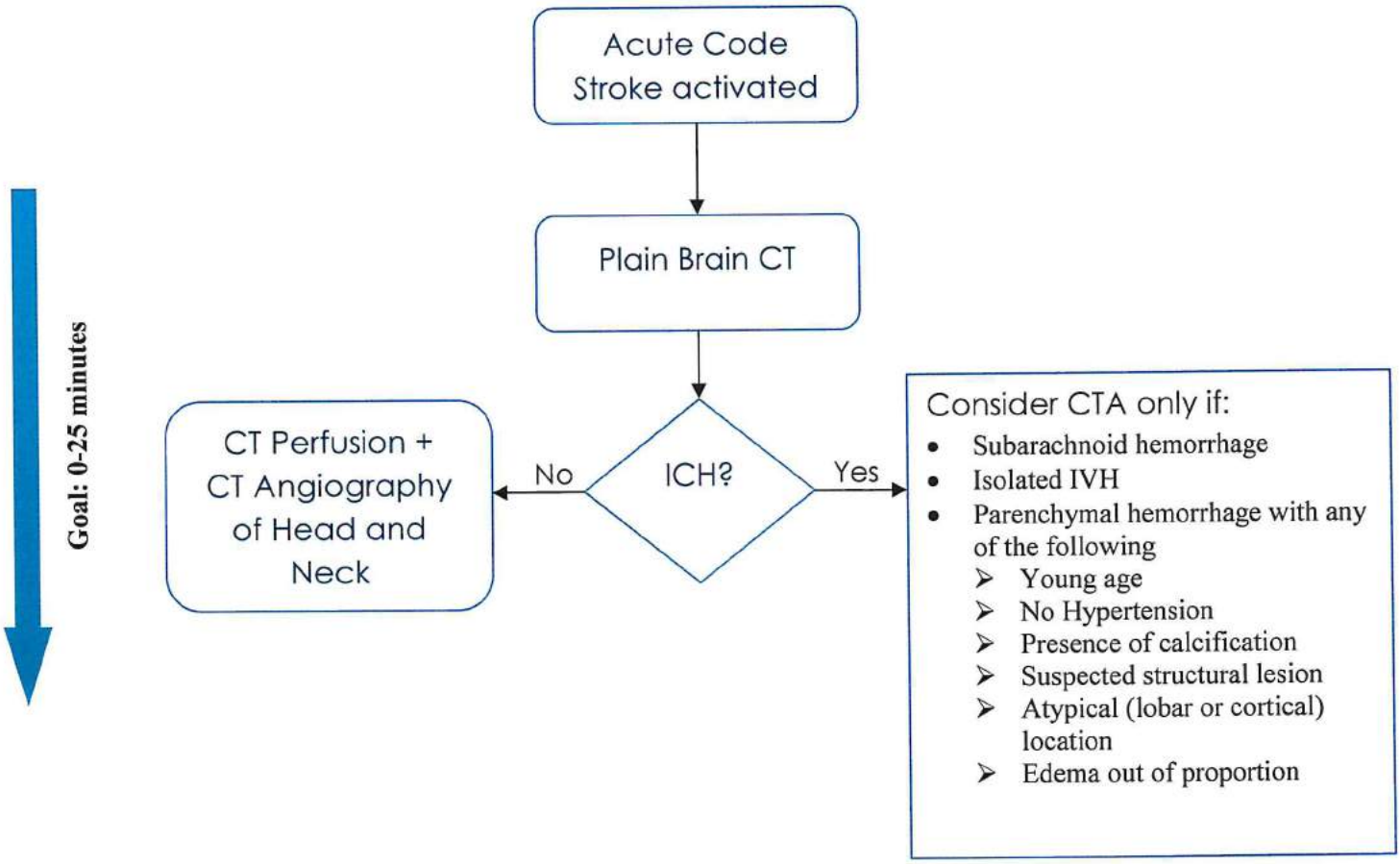
- Assess vital signs and resuscitate
- Ensure emergent CT brain arranged
- Insert two large bore IVs
- Arrange URGENT bloods
- Perform ECG

Neuroimaging Protocol

1. Brain CT is indicated within 6 hours from onset of stroke symptoms for anterior cerebral circulation (carotid system and its intracranial branches) and within 12 hours from onset for posterior cerebral circulation (vertebral-basilar system and its intracranial branches). Brain CT should still be performed if time is uncertain, e.g. "wake-up" stroke, unwitnessed stroke, etc.
2. After code stroke activation, the CT technologist and radiologist should head to the CT room immediately.
3. The CT requested from the ED should encompass three studies: Plain CT of the brain, CT perfusion of the brain and CT angiography of the head and neck starting from the aortic arch.
4. Multiphasic CT angiography can be done if CT perfusion is not available.
5. CT technologist notifies the ED to shift the patient to the CT suite.
6. The patient must arrive to the CT suite accompanied by the ED nurse, medical orderly and neurologist/physician. The neurologist/physician should be ready to give sedation in uncooperative patients.
7. Plain CT is performed first and if intracranial hemorrhage and stroke mimics are excluded by the radiologist then CT perfusion of the brain and CT angiography of the head and neck from the aortic arch to the vertex is performed.
8. The CT technologist will process the CT perfusion maps and CT angiography of the head and neck.
9. The radiologist must call the neurologist / physician / ED physician with the results of the imaging within 10 minutes.
10. Radiologist or neurologist / physician should contact the interventional neuroradiologist once a potentially eligible patient for mechanical thrombectomy is identified even before the results of the imaging (refer to inclusion criteria).
11. If subarachnoid hemorrhage is observed, a CT angiography of the head and neck should be performed to determine the presence of underlying vascular pathology (e.g. aneurysm or vascular malformation) in patients where the apparent etiology is uncertain.

12. If cerebral venous thrombosis is suspected, CT venography (CTV) should be done if there is no contraindication for the contrast study. MRV may also be considered.
13. All patients who receive IV rt-PA and /or mechanical thrombectomy should have a repeat plain CT of the brain after 24 hours or earlier if clinical deterioration.

Stroke Neuroimaging Algorithm



Thrombolysis Protocol

This protocol applies to the use of IV rt-PA (Alteplase) for acute ischaemic stroke only.

1. At the ED resuscitation (or CT suite), the Internal Medicine physician / Neurologist and Stroke Nurse must perform the following. It is essential that these steps are carried out in parallel:
   1.1. Confirm history with patient and / or EMS, family, witnesses or general practitioner with particular reference to stroke onset time, medical history, advance care directive and medications.
   1.2. Perform neurological exam and calculate National Institute of Health Stroke Scale (NIHSS).
   1.3. Complete the checklist of inclusion/exclusion criteria for intravenous rt-PA.
   1.4. Identify any potential bleeding sources.
   1.5. Assess vital signs every 15 minutes.
   1.6. Ensure ED doctor / Nurse Responsibilities are completed.
   1.7. Obtain and document all results (i.e. ECG, blood tests, and vital signs).
   1.8. Assist and supervise patient during transfer to CT suite.
   1.9. Review CT brain with radiologist to rule out hemorrhage, major hypodensity or other lesion that would contraindicate IV rt-PA therapy.
   1.10. Ensure hospital bed manager has arranged a bed.
   1.11. Obtain verbal consent for IV rt-PA (if applicable).
   1.12. Immediately discuss with stroke / neurology consultant (If certain that benefit to harm ratio of rt-PA favors thrombolysis, administer as per Thrombolysis Protocol).
   1.13. Ensure eligibility for endovascular intervention (refer to Mechanical Thrombectomy protocol).
   1.14. Lower BP to below 180/110 mm Hg, before administering IV rt-PA and ensure stabilization of BP level below this range during and after rt-PA infusion.
   1.15. Correct hypotension with IV fluids and vasopressors aggressively.
   1.16. Counsel patient and family.

1.17. IV rt-PA administration should not be delayed for urinary catheterization, NGT insertion or other bedside procedures.

2. Informed Consent

Whilst written consent is not required for IV rt-PA therapy, every effort possible should be made to contact the patient's legally authorized representative (next of kin or close family members) in order to advise them of the risks and benefits involved and obtain proxy consent. A physician's note documenting explicit discussion in a consent conversation is acceptable. In an emergency, when the patient is not competent and there is no available legally authorized representative to provide proxy consent, it is both ethically and legally permissible to proceed with IV thrombolysis. This consent should include Mechanical Thrombectomy if indicated.

3. Blood Pressure Management

Very high blood pressure should be treated to a target of below 180/110 mmHg before IV thrombolysis can be initiated. The agents of choice are:

3.1. Labetalol 10 mg IV over 1 to 2 minutes, may repeat every 5 to 10 minutes (may repeat once or twice)

3.2. Hydralazine 10 mg to 20 mg IV, may repeat every 15 minutes (may repeat once or twice)

It is important to ensure that the patient should not become hypotensive.

4. Blood Glucose Management

4.1. Hypoglycemia should be corrected emergently with IV 50% Dextrose.

4.2. Hyperglycemia > 10 mmol/l (180 mg/dl) should be treated with Insulin, with the first dose administered intravenously before initiation of IV rt-PA.

4.3. Insulin sliding scale as per hospital local protocol should be followed routinely for all cases with acute stroke with hyperglycemia.

5. IV rt-PA Administration

The following steps must be followed to prepare rt-PA:

5.1. rt-PA is supplied in 50 mg vials with diluent solution (sterile water). The 50 mg vial is reconstituted with 50 ml of diluent using the transfer cannula provided. The transfer cannula must be introduced vertically into the rubber stopper and through the mark at its centre. Alternatively, a large bore 19-gauge needle can be used.

5.2. The indicated dose is 0·9 mg/kg of the patient's estimated weight to a maximum dose of 90 mg. 10% (0·09 mg/kg) of the dose is administered as an intravenous bolus and the remaining 90% (0·81 mg/kg) is given as an infusion. It should be reconstituted to a concentration of 1 mg/ml using only the diluent (sterile water for injections) provided for reconstitution. Dissolving the powder should be by gentle agitation to prevent excess foaming.

5.3. Draw up the bolus dose in a 5-10 ml syringe. The bolus is to be administered over 1 minute.

5.4. Draw up the rest of the infusion dose in 50 ml syringe (note 2 x 50ml syringes will be required for amount > 50 ml). The infusion is to be administered over 60 minutes.

5.5. Attach the infusion tubing to the syringe and attach Luer-lock cannula to the other end.

5.6. Insert syringe into syringe pump, prime line as per pump instructions and attach to patient.

5.7. If 2 syringes are used, the syringe driver should still be set to infuse the total dose remaining over 1 hour.

5.8. After the infusion is completed, flush the infusion line with 30 ml 0.9% Sodium Chloride to ensure all drug is infused. IV rt-PA is compatible with sodium chloride 0.9%, not with glucose containing fluids or with fluids containing preservatives.

5.9. Disconnect syringe infusion from patient. Leave IV cannula in situ.

5.10. The total dose of IV rt-PA used for the treatment of acute ischaemic stroke should not exceed 90 mg.

5.11. Avoid application of BP cuff to the arm used for the rt-PA infusion.

5.12. Use alternative IV line for administration of other indicated medications (e.g. Labetalol, Insulin).

6. Post-Thrombolysis Care

6.1. Admit the patient to an ICU or ASU for monitoring. Patients nursed in the ASU should have a nurse to patient ratio of 1:1 for the first 24 hours following IV rt-PA administration.

6.2. The patient should be monitored by a specialized nurse for the first 24 hours.

6.3. Perform neurological assessments and monitor GCS and blood pressure post IV rt-PA at the following intervals:

6.3.1. Every 15 minutes for 2 hours

6.3.2. Every 30 minutes for 4 hours

6.3.3. Every hour until 24 hours (unless otherwise directed by treating physician).

6.4. If the patient develops severe headache, acute hypertension, nausea or vomiting discontinue an on-going rt-PA infusion and obtain an urgent brain CT scan.

6.5. Repeat brain CT at 24 hours to assess for asymptomatic haemorrhage and to allow initiation of antiplatelet therapy.

6.6. Delay placement of intra-arterial line (no punctures of arteries or large veins within 24 hours after starting IV rt-PA), nasogastric tube and Foley's catheter (avoid insertion until 8-24 hours post rt-PA infusion).

6.7. Increase the frequency of blood pressure measurements if systolic blood pressure >180 mmHg or diastolic blood pressure of >110 mmHg. Administer antihypertensive medications to maintain blood pressure at or below these levels.

6.8. If systolic BP still exceeds 180 mmHg, or diastolic BP exceeds 110 mmHg consider early transfer to ICU for intra-arterial blood pressure monitoring and management.

6.9. If emergency venepuncture is required, apply direct pressure to the site for 20 minutes after blood collection.

6.10. Watch for allergic reaction and monitor for tongue swelling.

6.11. Watch for bleeding from any site.

6.12. Do not initiate antiplatelet therapy or anticoagulation within 24 hours after starting IV rt-PA.

6.13. Commence blood glucose monitoring for 8 hours post rt-PA infusion.

6.14. Mobilise only with nursing assistance (including toilet use) after rt-PA for 24 hours as the patient is at risk of bleeding from falls.

6.15. Additional Nursing Responsibilities include nutrition / dysphagia screen / Speech Pathology referral.

7. Management of Complications

7.1. *Management of Oro-lingual Angioedema*

Isolated angioedema should be distinguished from anaphylaxis. Angioedema threatening the airway warrants the following actions:

7.1.1. Consider stopping rt-PA immediately (depending on severity of stroke and reaction).

7.1.2. Administer oxygen and monitor saturation.

7.1.3. Monitor for stridor and prepare for possibility of intubation or cricothyrotomy.

7.1.4. Administer IV Chlorpheniramine10-20 mg followed by IV Ranitidine 50 mg.

7.1.5. If tongue continues to swell after the above steps have been completed then administer Methylprednisolone (Solu-Medrol) 80-100 mg IV.

7.1.6. If the orolingual angioedema has not halted at this point, then urgently:

7.1.6.1. Administer Epinephrine 1:1000 0.3 ml SC or by nebulizer 0.5 ml.

7.1.6.2. Consult ENT/anesthesiology or the appropriate in-house service immediately for possible emergency cricothyrotomy / tracheostomy or fiberoptic nasotracheal intubation if oral intubation fails.

7.2. *Management of Anaphylaxis*

Anaphylaxis is rarer than isolated angioedema.

7.2.1. Consider stopping rt-PA immediately (depending on stroke severity and reaction).

7.2.2. Administer oxygen and monitor airway.

7.2.3. Administer Epinephrine 1:1000 0.3 ml IM.

7.2.4. Administer Chlorpheniramine10 mg IV.

7.2.5. Administer Hydrocortisone 200 mg IV.

7.2.6. If hypotensive, start fluid resuscitation.

7.2.7. Administer nebulized Salbutamol 2 mg for bronchospasm, repeat Epinephrine if no response.

7.2.8. Consider Epinephrine infusion 1-4 mcg/min IV if inadequate response.

7.3. *rtPA extravasation*

7.3.1. Change infusion to alternate IV site for continuation of drug.

7.3.2. It is not necessary to re-dose drug.

7.3.3. Treat infiltrated site locally with elevation and warm compress.

7.4. *Management of ICH*

The risk of ICH is increased with old age, diabetes, severe hyperglycemia, uncontrolled hypertension and cerebral small vessel disease on baseline CT scan.

7.4.1. When sudden neurologic decline occurs during rt-PA infusion, the infusion should be immediately stopped.

7.4.2. CT scan should be obtained emergently.

7.4.3. Control of hypertension (systolic target 140-160 mm Hg) -refer to ICH Protocol for further details.

7.4.4. Consult Neurosurgery.

7.4.5. Consider consulting Hematologist.

7.4.6. Consider immediately sending Fibrinogen level and empirically transfusing 10 U Cryoprecipitate. Anticipate giving more cryoprecipitate as needed to achieve a Fibrinogen level of ≥150 mg/dL (10 U cryoprecipitate increases fibrinogen by nearly 50 mg/dL). Consider prioritizing cryoprecipitate infusion over other reversal agents.

7.4.7. Check Fibrinogen levels and recheck every 4 hours.

7.4.8. Consider transfusing 8-10 units of Platelets if there is evidence of low platelets or platelet dysfunction.

7.4.9. Consider administering 25–50 U/kg of Prothrombin Complex Concentrate (PCC) as an adjunctive therapy to cryoprecipitate if patient was on Warfarin before rt-PA administration.

7.4.10. Consider administering 12 ml/kg of FFP if patient was on Warfarin before rt-PA administration if PCCs not available.

7.4.11. Consider administering 10 mg IV Vitamin K if patient was on Warfarin before rt-PA administration.

7.4.12. Consider administering one of the following anti-fibrinolytic agent:

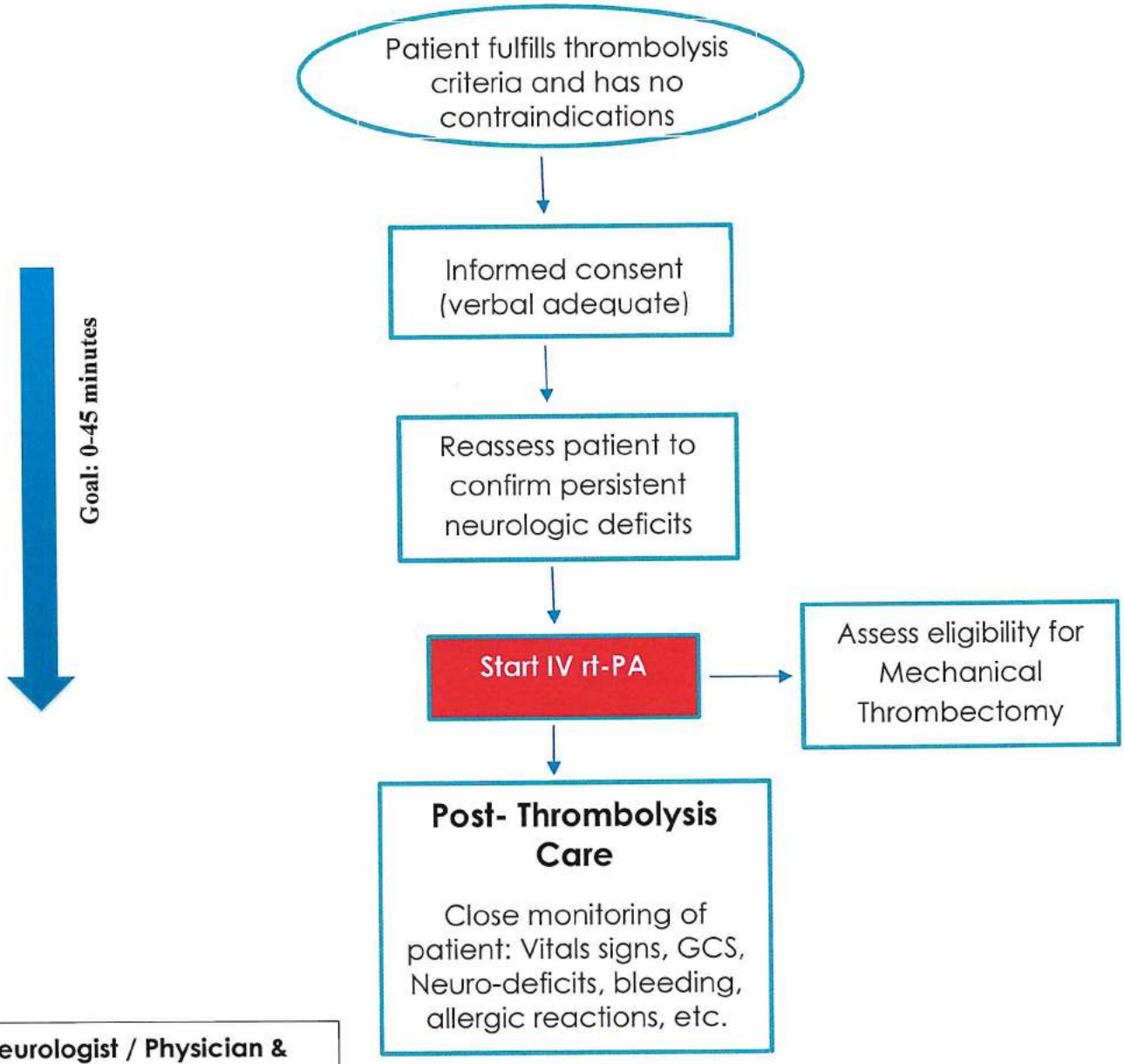
7.4.12.1. Aminocaproic acid: 4 g IV during first hour followed by 1 g/h for 8 hours

7.4.12.2. Tranexamic acid: 10 mg/kg 3-4 times/day (adjustment based on kidney function may be necessary)

7.4.13. Periodic blood work (CBC, PT/PTT) to re-assess coagulation status & need for blood transfusion

7.4.14. Consider repeat CT head to assess for ICH growth

Thrombolysis for Acute Ischemic Stroke Algorithm



Neurologist / Physician & Nurse responsibilities

- Confirm history
- Perform NIHSS
- Complete thrombolysis checklist
- Obtain consent
- Assess vital signs every 15 minutes
- Ensure inpatient bed arranged

Mechanical Thrombectomy Protocol

1. Mechanical Thrombectomy may be indicated in the following situations:

   1.1. In the setting of anterior circulation stroke with large artery occlusion [ICA, proximal MCA (M1), MCA bifurcation, proximal ACA (A1)] within 6 hours of symptom onset whether or not IV rt-PA was given. For certain stroke situations > 6-24 hours, refer to Mechanical Thrombectomy Protocol.

   1.2. In the setting of posterior circulation stroke with large artery occlusion [Basilar, Vertebral, proximal PCA (P1)] within 12 hours of symptom onset in exceptional circumstances.

   1.3. CT perfusion study shows a favorable ischemic penumbra to core ratio (ratio of at least 2) or the presence of collaterals on multiphasic CTA and occlusion of major vessel.

   1.4. Rescue of stroke cases where IV rt-PA is contraindicated such as stroke following recent surgery (< 14 days), recent STEMI (<4-6 weeks), pregnancy, age < 18 and in cases of severe basilar thrombosis not responding to IV rt-PA.

2. Mechanical Thrombectomy is contraindicated in the following situations:

   2.1. Matched CBV and perfusion defects in the brain perfusion CT study or no collaterals on multiphasic CTA.

   2.2. No or difficult vascular access to the intra-cranial arteries.

   2.3. Uncontrollable hypertension: systolic BP ≥180 mmHg or diastolic BP > 110 mmHg on repeated measures despite treatment with an anti-hypertensive infusion.

   2.4. Pre-existing dementia or dependency (modified Rankin score >2).

   2.5. Severe comorbidity limiting life expectancy or posing treatment risk.

3. Procedural Care

   3.1. Eligible cases to be transferred to the angiography suite immediately even if IV rt-PA is still ongoing.

3.2. The interventional neuroradiologist to summon the neurointerventional team, which is composed of angiography suite nurse, angiography technologist and anesthesiologist.

3.3. Informed consent should be obtained from the patient or the patient's legally authorized representative by the interventional neuroradiologist or neurologist.

3.4. Procedural sedation with anesthesiologist support is the preferred option for the procedure however, if not possible, then general anesthesia (with careful maintenance of BP at induction) may be an option.

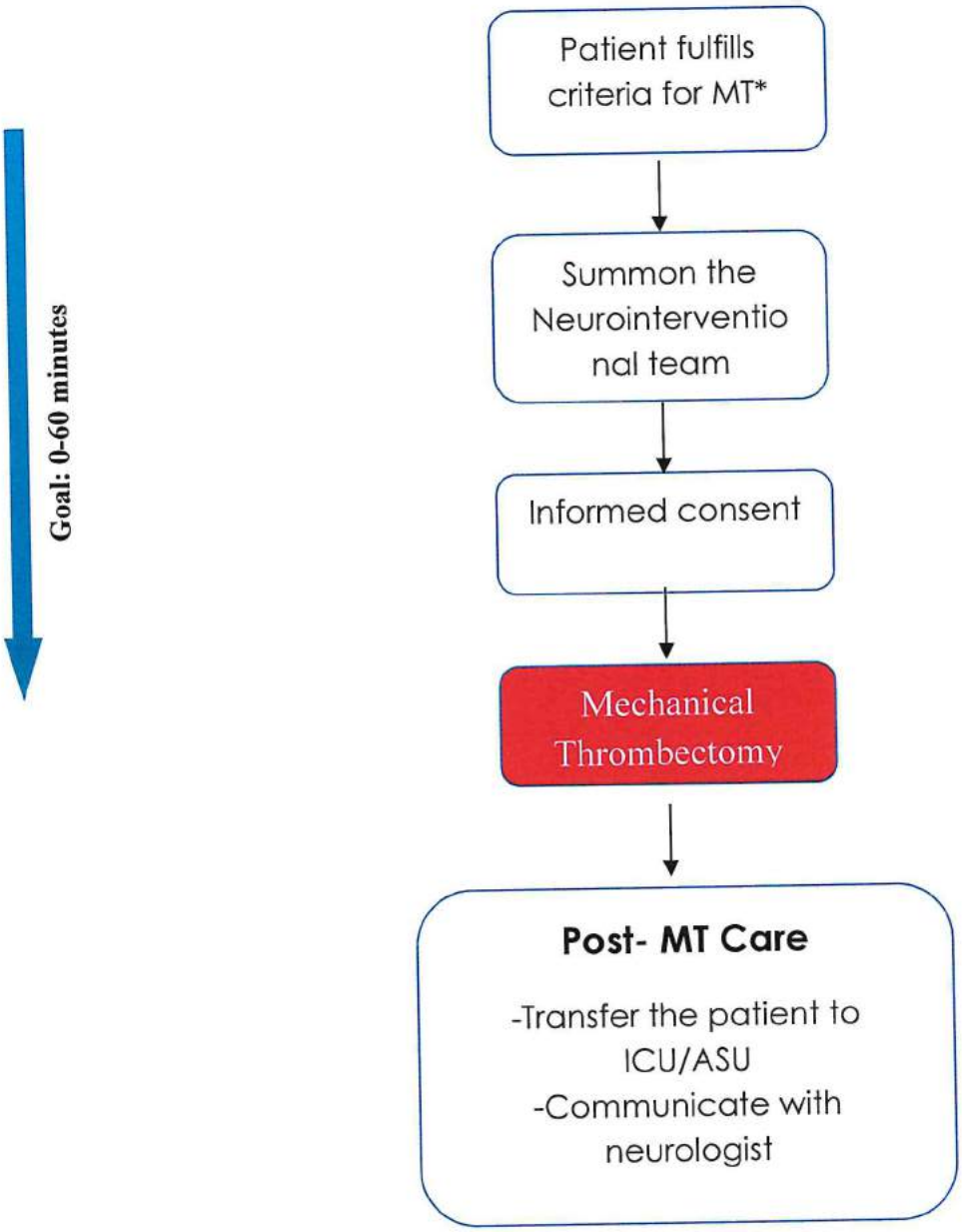
4. Post-procedural Care

4.1. The patient should be monitored in ICU/ASU (1:1 nursing care) for at least 24 hours.

4.2. If the femoral sheath is placed in the femoral artery and was left in situ, it has to be kept patent by continuous pressure flush and then it should be removed as per written orders. The BP has to be normalized before removing the sheath. After removal of the sheath, the patient has to be placed supine for 6 hours with the accessed leg straight.

4.3. Check for bleeding/hematoma at the groin puncture site, ipsilateral pedal pulse and neurological exam every 15 minutes for the first 2 hours then, every 30 minutes for 2 hours then, every 60 minutes for the remaining 24 hours.

Mechanical Thrombectomy Algorithm



Intracranial Hemorrhage (ICH) Protocol

1. Medical Management

1.1. Admit the patient to ICU/HDU

1.2. Perform neurological assessments and monitor GCS and blood pressure at the following intervals:

1.2.1. Every 15 minutes for 2 hours

1.2.2. Every 30 minutes for 4 hours

1.2.3. Every hour until 24 hours

1.3. Keep on cardiac monitoring for at least 24 -48 hours.

1.4. Urgent control of elevated BP and correction of coagulopathy should be considered to limit hematoma enlargement. For Hypertension (systolic BP >150 mm Hg), acute lowering of BP to 140 mmHg is probably safe (initial reduction by 15% of systolic BP, further reduction to target over several hours with GCS monitoring). Options for intravenous agents include:

1.4.1. Labetolol 20 mg IV over 2 min initially, then 20-40 mg IV q 10min (total dose not to exceed 300 mg). Once target BP is reached, maintain on Labetalol infusion 0.2 mg/Kg/hr.

1.4.2. Hydralazine 5 to 20 mg IV every 30 min or infusion at1.5 to 5 ug/kg.

1.5. Early deterioration is common – usually due to expansion of hematoma. In case of worsening sensorium or anticipated deterioration, consider urgent CT scan and neurosurgical opinion for possible intervention.

1.6. Select patients with ICH should be considered for an elective MRI (or CT) angiographic study to exclude an underlying lesion e.g. aneurysm, AV malformation, tumor, etc. While an early study may demonstrate some of these, if doubt persists, a delayed imaging after few weeks, when the hematoma has resolved, should be considered.

1.7. Aggressive management of the blood Glucose (to be maintained at 8- 10mmol/l) with regular insulin sliding scale or insulin infusion with close monitoring of blood glucose to avoid hypoglycemia.

1.8. Clinical seizures should be treated with IV antiepileptic drugs. Options include:

1.8.1. IV Phenytoin 18 mg/kg loading dose followed by 5 mg/kg/day maintenance

1.8.2. IV Sodium Valproate 20-40 mg/kg loading dose followed by 10 mg/kg TID or QID maintenance

1.8.3. IV Levetiracetam 20 mg/kg STAT and BID

1.9. Consider continuous EEG monitoring in ICH patients with depressed mental status to rule out non-convulsive seizures.

1.10. DVT prophylaxis

1.10.1. Start pneumatic leg compression or elastic stockings.

1.10.2. Start subcutaneous LMWH, e.g. Enoxaparin 0.5mg/kg body weight after 48 hours if intracranial hematoma is stable and there is no ongoing coagulopathy.

1.11. Swallowing assessment to minimize the risk for aspiration.

1.12. Start physical therapy early.

1.13. For ICH in patients with coagulopathy:

1.13.1. Involve Hematologist early.

1.13.2. Consider delegating personnel for urgent procurement of necessary replacement factors for infusion within minutes.

1.13.3. Choose rapidly acting methods for initial correction.

1.14. ICH secondary to Warfarin (INR $\geq$ 1.4)

1.14.1. Stop Warfarin

1.14.2. Administer vitamin K 10 mg by slow IV infusion

1.14.3. Administer 25–50 U/kg of Prothrombin Complex Concentrate (PCC) (If PCC not available administer FFP at 10-15ml/kg or cryoprecipitate).

1.15. ICH secondary to thrombocytopenia

1.15.1. Start Platelets transfusion to maintain the count >100/mm3.

1.15.2. Consider IV immunoglobulin total of 2 gram/kg for immune-mediated thrombocytopenia.

1.16. ICH secondary to Heparin/LMWH

1.16.1. Administer Protamine sulphate (1 mg of Protamine sulphate neutralizes the 100 units of heparin).

1.16.2. Monitor the PTT 5-15 minutes after the dose and then 2-8 hourly.

1.16.3. Start FFP at 10-15ml/kg

1.17. ICH secondary to NOACs

1.17.1. Start supportive care, as no antidote is available.

1.17.2. Consider administering Activated Charcoal 50 grams if airway is secured.

1.17.3. Consider administering Prothrombin Complex Concentrate only after consultation with hematologist.

1.17.4. Consider hemodialysis in case of Dabigatran.

2. ICP monitoring and treatment

Management principles for elevated ICP recommend placement of an ICP monitor in patients with a GCS score of 3-8 and maintenance of an ICP <20 mm Hg and a CPP of 50-70 mm Hg. Methods of treating elevated ICP include:

2.1. Elevation of the head of the bed to 30°-45°.

2.2. The use of mild sedation and avoidance of collar-endotracheal tube ties that might constrict cervical veins.

2.3. Mannitol or Hypertonic Saline or both may be used to treat acute ICP elevations.

2.4. In patients with CSF outflow obstruction caused by hydrocephalus or a trapped ventricle or IVH, CSF drainage should be considered.

2.5. Hematoma evacuation and decompressive craniectomy (DC) are options for treating elevated ICP. Salvage therapies might include barbiturate coma or mild hypothermia.

3. Surgical Management

3.1. *Supratentorial hemorrhage*

Hematoma evacuation is indicated in the following situations:

3.1.1. Lobar hematoma located less than 1cm from the cortical surface

3.1.2. Growing hematomas, and large hematomas

3.1.3. Supratentorial hematoma evacuation in deteriorating patients might be considered as a life-saving measure

3.1.4. Large hematoma with significant midline shift

3.1.5. Large hematoma with elevated ICP refractory to medical treatment

3.2. *Cerebellar hemorrhage*

Urgent surgical evacuation of the hematoma is indicated in the following situations:

3.2.1. Hemorrhage >3cm in diameter or those with brainstem compression or hydrocephalus from ventricular obstruction

3.2.2. Patients with cerebellar hemorrhage who are neurologically deteriorating more than 2 points in GCS

Acute Ischemic Stroke Protocol (not eligible for IV rt-PA)

All such patients should be initially stabilized in the ED and then admitted at the earliest instance to a Stroke Unit or Neurology ward or ICU (as appropriate).

1. General Stroke care (These apply to most subcategories of ischemic stroke):

1.1. Vital signs (2-4 hourly); GCS and cardiac monitoring (esp. for Atrial Fibrillation or cardiac ischemia) for at least 24-48 hours (longer in selected patients).

1.2. Administer anti-platelet agents immediately after diagnosing Ischemic Stroke (Including larger artery stroke, lacunar stroke, and stroke of undetermined cause). Regimen includes oral Aspirin 300-325 mg loading dose followed by 81 mg OD with oral Clopidogrel 300 mg loading dose followed by 75 mg OD.

1.3. Consider starting statin therapy.

2. Control of BP

2.1. Hypotension should be promptly treated with IV fluids and vasopressors as appropriate.

2.2. Treat hypertension only when BP > 220/120 mm Hg or patient has coexisting evidence of acute end-organ damage.

2.3. For persistent BP > 220/120 mm Hg, reduce the MAP by 15% in first 24 hours (with further graded reduction later). Options for intravenous agents include:

2.3.1. Labetolol 20 mg IV over 2 minutes initially, then 20-40 mg IV q10min (total dose not to exceed 300 mg). Once target BP is reached, maintain on Labetalol infusion 0.2 mg/Kg/hr.

2.3.2. Hydralazine 5 to 20 mg IV every 30 min or infusion at 1.5 to 5 ug/kg.

2.3.3. Nitroprusside sodium infusion, start at 0.3 mcg/kg/min and titrate to desired effect (max 10 mcg/kg/min x 10 min). Caution should be exercised in cases of large strokes or elevated ICP.

2.4. In patients with evidence of end organ damage, e.g. ongoing cardiac ischemia, aortic dissection, overt cardiac failure and acute renal failure, consider rapid lowering of BP to normal levels, with close monitoring of neurologic status. Consult Cardiology / Cardiac Surgery / Vascular surgery as appropriate.

2.5. In specific circumstances such as major artery stenosis / occlusion causing focal cerebral ischemia, induced hypertension with IV fluids and vasopressors may be considered with close monitoring.

2.6. Monitor GCS and neurologic deficits in all patients requiring reduction in BP. In case of worsening focal deficits / sensorium with the decrease in BP, consider increasing BP partially or to previous levels and observe for neurologic improvement.

2.7. In patients with preexisting HTN, restart the patient's regular antihypertensive therapy 24 hours after the onset and when neurologically stable in a graded manner - unless there is specific contraindication to restarting treatment.

3. Blood Glucose Management

3.1. Hypoglycemia should be promptly treated.

3.2. Hyperglycemia should be treated in the acute stage with Insulin (e.g. using Insulin sliding scale as per hospital local protocol) targeted to a serum Glucose level of 8-10 mmol.

4. IV Fluids

4.1. Hypovolemia / hypotension should be promptly treated. Maintenance fluid infusion in acutely ill patients or those NPO is appropriate, preferably with Normal Saline.

5. General Measures

5.1. Start LMWH prophylaxis e.g. SC Enoxaparin 1 mg/kg body weight (if not contraindicated); also, apply pneumatic compression devices / stockings.

5.2. If patient has dysphagia (and normal sensorium), perform swallowing assessment and limit oral feeds to minimize the risk for aspiration. Consider NGT placement to facilitate medication and feeding.

5.3. Arrange early second line investigations as indicated i.e. MRI brain with MRA (alternative – CT angiogram of neck and cerebral vessels); Echocardiography; Holter study; Carotid/vertebral Doppler Ultrasound, etc.

5.4. Arrange for hematological, autoimmune workup, lumbar puncture, tests for neuro-infection, etc. as indicated. Consider these in 'Stroke in Young' or stroke in unusual contexts.

6. Patients with Altered Mental Status

6.1. Closely monitor GCS, focal deficits, pupils and vital signs, with 1:1 nursing care. Monitor intake/output; administer Oxygen as needed.

6.2. Consider intubation for persistent Coma (GCS $\leq$8).

6.3. Consider NGT placement for medication and feeding.

6.4. Consider IV Mannitol / Hypertonic Saline for patients with raised ICP.

6.5. Consider early Neurosurgical consultation for possible decompressive craniectomy (e.g. Malignant MCA stroke; cerebellar stroke) or external ventricular drainage (for hydrocephalus)

6.6. Consider metabolic causes of coma and systemic or neurologic infection, and treat as indicated.

6.7. Consider non-convulsive status epilepticus and treat accordingly with anticonvulsant agent.

7. Anticoagulation for cardio-embolic TIA/Stroke

Stroke from a cardio-embolic source should be considered in patients with atrial fibrillation (ongoing or paroxysmal), valvular abnormalities, prosthetic cardiac valves, intra-cardiac clots and multifocal strokes on brain imaging. Most patients with cardioembolic stroke require anticoagulation for optimal prevention of stroke recurrence. Anticoagulation should be initiated after careful assessment for contraindications and also evaluation of serial brain imaging.

7.1. Prevention of recurrent stroke in patients with non-valvular atrial fibrillation

7.1.1. Patients with transient ischemic attack or ischemic stroke and non-valvular atrial fibrillation should receive oral anticoagulation.

7.1.1.1. In most patients requiring anticoagulants for atrial fibrillation, direct non-vitamin K oral anticoagulants (NOACs) such as Apixaban, Dabigatran, Edoxaban, or Rivaroxaban should be prescribed in preference over Warfarin.

7.1.1.2. For patients already receiving Warfarin with good INR control (range 2–3), continuing Warfarin is a reasonable anticoagulation option.

7.1.1.3. When selecting choice of oral anticoagulants, patient specific criteria should be considered.

7.1.1.4. For patients with acute ischemic stroke and atrial fibrillation, routine use of bridging with Heparin is not recommended. Bridging with antiplatelet therapy is suggested until the patient is anticoagulated.

7.1.1.5. For patients with ischemic stroke or TIA and atrial fibrillation who are unable to take oral anticoagulant therapy (NOAC or warfarin), aspirin alone is recommended.

7.1.1.6. The addition of Clopidogrel to aspirin therapy, compared with aspirin therapy alone, may be reasonable and decisions should be individualized based on patient bleeding risk.

7.1.1.7. For patients with a mechanical heart valve, Warfarin is recommended for stroke prevention with careful INR monitoring; NOACs are contraindicated.

7.1.1.8. For patients in whom long-term anticoagulant therapy is contraindicated, a left atrial appendage closure procedure may be considered.

8. Clinical Considerations for anticoagulation

8.1. The optimal timing to start anticoagulant therapy after stroke has not been defined by clinical trial evidence, and should be based on individual benefit / risk assessment taking

into account the clinical circumstances, infarct size, imaging appearances, age, comorbidities, and estimated stroke recurrence risk.

8.2. A general approach to the target timing for initiation of oral anticoagulant therapy post-stroke is as follows: 1 day post-event after a TIA, 3 days post-stroke after a mild stroke, 6 days post-stroke after a moderate stroke and 12 days post-stroke after a severe stroke.

9. Symptomatic Carotid Stenosis

9.1. Patients with 50-69 % carotid stenosis should have an evaluation by a stroke expert and for selected patients (young age, male sex, no comorbidities) if the perioperative morbidity and mortality risk is estimated to be <6% they should be offered early carotid endarterectomy or carotid stenting (preferably within 14 days).

9.2. Patients with 70-99% carotid stenosis should be considered for carotid endarterectomy/carotid stenting within 14 days if the perioperative morbidity and mortality risk is estimated to be <6%.

9.3. Carotid endarterectomy is generally more appropriate than carotid stenting for patients over age 70 years who are otherwise fit for surgery.

9.4. Carotid stenting may be considered for younger patients and patients who are not operative candidates for technical, anatomic or medical reasons.

10. Asymptomatic and Remotely Symptomatic Carotid Stenosis

10.1. Carotid endarterectomy may be considered for selected patients with 60-99 % carotid stenosis who are asymptomatic or were remotely symptomatic (e.g. duration > 6 months, contralateral carotid disease).

10.2. Carotid stenting may be considered in patients with 60-99 % carotid stenosis who are not operative candidates for technical, anatomic or medical reasons.

11. Intracranial Stenosis

11.1. Intracranial stenting is not recommended for the treatment of recently symptomatic intracranial 70% to 99% stenosis.

11.2. Medical management includes dual antiplatelet therapy with ASA 325 mg and Clopidogrel 75 mg to be started within 30 days of stroke/TIA and treated for up to 90 days. In addition, aggressive management of all vascular risk factors is recommended.

11.3. If symptoms persist on dual antiplatlets, the patients should be considered for intracranial revascularization by angioplasty with or without stenting.

12. Cervicocephalic Artery Dissection

12.1. Antithrombotic therapy for stroke prevention is recommended for extracranial carotid or vertebral artery dissection.

12.2. Choice of treatment and duration should be based on individual risk/benefit analysis. Either antiplatelet therapy or anticoagulation with heparin or warfarin is considered reasonable options.

13. Special Stroke Situations

13.1. *Cerebellar Infarction with evidence of brain stem compression*

13.1.1. Close monitoring with serial neurological exam (e.g. for 6th nerve or gaze palsy, worsening of GCS) – for evidence of brainstem compression or herniation

13.1.2. Repeat CT scan for evidence of brainstem compression, herniation or hydrocepahalus.

13.1.3. IV Mannitol 100-300 ml QID or Hypertonic Saline 100-150 ml QID (as a temporary measure till definitive intervention).

13.1.4. Decompressive craniectomy should be considered for cerebellar infarcts with mass effect/ obliteration of basal cisterns/brainstem compression and without significant brainstem infarction, altered mental status, hydrocephalus or tonsillar herniation.

13.2. *Large hemispheric infarction with midline shift (Malignant MCA infarct)*

13.2.1. Close monitoring with serial neurological exam

13.2.2. Repeat CT scan in case of any deterioration

13.2.3. Measures to control raised ICP (as temporizing measures): head elevation 15-30 degrees; IV Mannitol (20%) – 100-300 ml QID or IV 3% Hypertonic Saline 100-150 ml every 6-8 hours with monitoring of serum Na and Osmolality

13.2.4. Control pain; correct hypoxemia and hypercapnea; consider hyperventilation to pCO2 25-30 mmHg.

13.2.5. Early elective Neurosurgery consultation for possible surgical decompression, large infarcts with mass effect, midline shift, brain herniation, altered mental status to be considered for wide decompressive craniectomy.

13.2.6. Significant hydrocephalus may occasionally require ventricular drainage.

13.2.7. Indications for decompressive craniectomy include:

13.2.7.1. Modified Rankin score 0-2 (pre-stroke).

13.2.7.2. Stroke onset up to 120 hours.

13.2.7.3. NIHSS score of >14 in non-dominant hemisphere stroke, and > 19 in dominant hemisphere stroke.

13.2.7.4. Total infarcted tissue > ⅔ of the MCA territory or a total volume of infarcted tissue > 80ml or Midline shift of > 5mm

13.2.8. Contraindications for decompressive craniectomy include:

13.2.8.1. Modified Rankin score > 2 (pre-stroke)

13.2.8.2. GCS < 8

13.2.8.3. Pupils fixed and dilated bilaterally

13.2.8.4. Co-existing brain lesions affecting outcome

13.2.8.5. Coagulation disorders - unless corrected to a level of INR <1.4 and / or platelet function to normal, and platelet count of >100,000. Other coagulopathies are not existent, or if present, complete reversal and cover is available for the first 7 days after surgical intervention.

13.2.8.6. Pregnancy - unless target is to save the fetus.

13.3. *Cerebral Venous Thrombosis*

Management of CVT includes:

13.3.1. Resuscitate and stabilize

13.3.2. Detailed history & examination

13.3.3. Emergent Brain imaging: Brain CT with CTA/CTV or MRI with MRA/MRV (preferred).

13.3.4. Glucose, CBC, ESR, Biochemistry, Coagulation profile, CXR, etc.

13.3.5. Consider IV Benzodiazepine / Phenytoin for seizures

13.3.6. Consider IV Mannitol or Hypertonic Saline for possible raised ICP

13.3.7. Begin anticoagulation if no general contraindication:

13.3.7.1. Initially SC LMWH e.g. Enoxaparin (weight based dose).

13.3.7.2. Anticoagulation recommended even in patients with ICH.

13.3.8. Admit to Stroke Unit / ICU / HDU

13.3.9. Monitor for signs of hemorrhage: bleeding, hypotension, drop in Hb, etc.

13.3.10. Monitor vital signs, GCS, pupils, limb power

13.3.11. Serial brain imaging

13.3.12. Treat underlying cause

13.3.13. Consider intubation for coma/ decerebration/ resistant status

13.3.14. If stable, bridge LMWH to long-term oral anticoagulation with Warfarin (target INR 2-3):

13.3.15. For transient reversible factors or low risk thrombophilia, continue 3-12 months.

13.3.16. For high risk or inherited thrombophilia continue lifelong treatment.

13.3.17. If showing neurologic deterioration or coma with significant mass effect and midline shift, consider decompressive craniectomy. If the deep venous system is involved, early mechanical venous thrombectomy and local thrombolysis should be considered.

13.3.18. If showing neurologic deterioration without significant mass effect, consider mechanical venous thrombectomy.

14. Management of non-disabling stroke and TIA

Patients presenting with TIA or minor stroke should have their risk calculated using the ABCD3-I screening tool and managed as follows:

14.1. Highest risk for stroke recurrence (presenting within 48h).

14.1.1. Should be immediately assessed in an ED if presented with unilateral motor weakness or speech disturbance (within one day if sensory or visual disturbance), and urgent brain imaging (CT or MRI) and/or CTA/MRA and ECG should be completed without delay.

14.2. Moderate risk for recurrent stroke (presenting between 48 h and two-weeks)

14.2.1. If presented with unilateral motor weakness or speech disturbance, should receive a comprehensive clinical evaluation and investigations, by a healthcare professional with stroke expertise within 24 h and within two-weeks if presented with sensory loss or visual disturbance.

14.3. Low risk for recurrent stroke (more than two-weeks)

14.3.1. Patients presenting following a suspected TIA or non-disabling ischemic stroke, may be considered as being less urgent, and should be seen within one-month of symptom onset.

14.3.2. Patients experiencing atypical sensory symptoms (such as patchy numbness and/or tingling) are generally considered as less urgent, and may be seen by a healthcare professional with stroke expertise as required almost within 3 months.

14.4. Patients with TIA who are not being considered for acute thrombolytic or endovascular therapy should undergo the following investigations:

14.4.1. CT angiography ('aortic arch-to-vertex') should be performed at the time of brain CT to assess both the extracranial and intracranial circulation.

14.4.2. Carotid ultrasound (for extracranial vascular imaging) and MRA are alternatives to CTA, and selection should be based on immediate availability, patient characteristics.

14.4.3. The following laboratory investigations should are part of the initial evaluation: hematology (CBC), electrolytes, coagulation [activated partial thromboplastin time (aPTT), international normalized ratio (INR)], renal function (creatinine, e-glomerular filtration rate), capillary glucose level

14.4.4. All should undergo an Echocardiogram, electrocardiogram (ECG), 24-48 Holter monitoring or prolonged ECG monitoring in selected patients.

14.4.5. All should be assessed for functional impairment when appropriate (e.g., cognitive evaluation, screening for depression, screening of fitness to drive, and functional assessments for potential rehabilitation treatment).

15. Young stroke workup below 50 years

In young patients with stroke (<50 years age), in addition to aforementioned investigations, the following may be considered based on clinical assessment:

15.1. Trans-esophageal Echocardiography (TEE), TEE with bubble study.

15.2. Test for Hemoglobinopathies e.g. Sickle cell disease

15.3. Tests for systemic autoimmune disorders: ESR, CRP, ANA, ANCA, etc.

15.4. Tests for Anti-phospholipid antibody syndrome: Phospholipid antibodies, Anti-cardiolipin antibodies, B2M.

15.5. Tests for pro-coagulant states: Levels of Protein C, Protein S, Anti-thrombin III, Factor VIII assay, Prothrombin (F2) G20210A; Factor V Leiden R506Q mutation, Serum Homocystein level, Lipoprotein A.

15.6. Lumbar puncture for CSF analysis – for possible neuroinfection, meningeal carcinomatosis, etc.

15.7. Conventional angiography: for evidence of CNS Angiitis.

In-hospital Stroke Protocol

The following management steps should be implemented for patients with a suspected stroke while hospitalized:

1. Activate the in-hospital Acute Stroke Team or Internal Medicine physician on-call.
2. Keep on cardiac monitor, pulse oximeter, monitor vital signs and check bedside glucose.
3. Order emergent Head CT as per imaging protocol.
4. Prepare order for IV rtPA.
5. Order stat blood tests: Coagulation profile, CBC, RFT, Troponin, Glucose.
6. Establish 2 large bore IV access.
7. Administer IV rt-PA once approved by neurologist / IM physician.
8. Assess eligibility for mechanical thrombectomy.
9. Transfer patient to ICU/ASU

Transfer/Transport Protocol

Pre-hospital

It is recommended that patients with suspected acute stroke to be transported directly to the nearest hospital capable of providing stroke care.

Inter-facility

1. *Stroke care hospitals classification*

The health institutions caring for stroke are divided into three different levels with the following criteria:

1.1. **Basic Stroke Capable Hospital**

A hospital that does not have the acute care capabilities required of advanced or comprehensive stroke capable hospitals. The following criteria should be met:

1.1.1. Availability of IV rt-PA therapy
1.1.2. Availability of capable ambulance transfer team.
1.1.3. Availability of neuro-imaging and lab services 24/7
1.1.4. Support of hospital administration.
1.1.5. Availability of a basic Acute Stroke team (IM physician / neurologist)
1.1.6. ED staff with training in Acute Stroke care.
1.1.7. NIHSS employed in initial Acute Stroke evaluation.
1.1.8. Outcomes and quality improvement process.
1.1.9. Continuing Medical Education (CME) in stroke management.

1.2. **Advanced Stroke Capable Hospital**

1.2.1. All Criteria for Basic Stroke capable hospital in addition to:
1.2.2. Availability of Acute Stroke team 24/7.
1.2.3. Written stroke care protocols.
1.2.4. Availability of transfer agreement with a comprehensive stroke capable hospital providing a higher level of care.

1.2.5. ED staff trained in acute stroke care.

1.2.6. Expertise in administering and managing IV rt-PA.

1.2.7. Availability of dedicated stroke unit and team.

1.2.8. Availability of Neurosurgery services 24/7.

1.2.9. Availability of physical, occupational, and speech therapy.

1.2.10. Availability of public and professional educational programs for the community

1.2.11. Written protocol for receiving stroke patients transferred from Basic Stroke Capable Hospitals and other facilities.

1.3. **Comprehensive Stroke Capable Hospital**

1.3.1. All criteria for advanced Stroke Center in addition to:

1.3.2. Personnel with expertise in Neuro-intervention radiology, Vascular surgery, Neurology, Neurosurgery, Neuroradiology, Critical Care available 24/7.

1.3.3. Availability of clinical nurse specialists / nurse practitioners.

1.3.4. Availability of advanced diagnostic techniques including MRI, MRA, CT/CTA, cerebral angiography and TEE.

1.3.5. Availability of rehabilitation specialists including physical, occupational, and speech therapy.

1.3.6. Availability of notification system whereby neurologist on-call notifies their emergency department of transfer and activates the hospital Code Stroke Protocol and provides estimated time of arrival. This process should also pre-notify radiology, stroke nurse and the bed manager of incoming activity.

1.3.7. Availability of Stroke Registry.

1.3.8. Availability of educational and research programs.

2. Transfer from Basic to Advanced or Comprehensive facility

2.1. If a patient eligible for reperfusion therapy presents to a basic health facility. Physician from referring the health facility should contact the neurologist on-call at the advanced or comprehensive stroke capable hospital.

2.2. Medical team from the referring hospital should arrange an ambulance to transfer the patient.

2.3. The patient responsibility remains under the referring hospital during the transport process.

2.4. An accompanying medical doctor is required if rt-PA infusion is being administered in transit.

2.5. The stroke team at the receiving hospital should continue with stroke protocols and assess the patient eligibility for thrombectomy.

3. Transfer from a thrombolysis incapable facility

3.1. ED doctor or IM physician should ensure eligibility for thrombolysis prior to transfer.

3.2. The referring hospital must notify the receiving stroke hospital prior to transport.

3.3. The referring hospital should arrange an ambulance to transfer the patient.

3.4. The patient responsibility remains under the referring hospital during the transport process.

3.5. A medical doctor or nurse should accompany the patient.

4. Transfer of a potential mechanical thrombectomy patient

4.1. IM physician or neurologist from referring hospital should contact neurologist on-call in Comprehensive Stroke hospital to confirm eligibility for mechanical thrombectomy and reach decision on transferring the patient.

4.2. If a stroke specialist is available at the referring hospital, they may contact the Interventional Neuroradiologist directly.

4.3. If agreed, IM physician or neurologist from the referring hospital is notified of acceptance of transfer and may then arrange ambulance transfer to Comprehensive Stroke hospital.

4.4. The patient responsibility remains with the referring hospital during the transport process.

4.5. An accompanying medical doctor is required if rt-PA infusion is being administered in transit.

4.6. The stroke team at the receiving hospital should repeat imaging and continue with other acute stroke protocols.

4.7. If the stroke patient is critically unwell (e.g. intubated), then the anesthesia and ICU doctors from both hospitals should be involved in the case discussion and patient transfer.

4.8. If patient found not to be eligible for MT on repeat imaging. This patient should be sent back to the referring hospital for further care.

Stroke Rehabilitation Protocol

As rehabilitation plays a major role in the recovery of stroke victims, evidences states that rehabilitation should be structured to be provided more intensely in the first six months. There are 3 phases of stroke rehabilitation including: acute inpatients rehabilitation, long-term rehabilitation and community rehabilitation. Due to resources constrains and the unavailability of dedicated rehabilitation unit and unavailability of community physiotherapy, this protocol shall mainly focus on the acute phase of stroke rehabilitation.

1. Active rehabilitation therapy should start within 24 hours once medical stability is reached.
2. During hospitalization all patients should receive at least 45 minutes of physiotherapy per day to ensure intensity and continuity.
3. The safety of all patients must be ensured during rehabilitation physiotherapy sessions.
4. No patient should be excluded from rehabilitation unless he / she is too ill or too cognitively devastated to participate in a treatment program.
5. Rehabilitation should be individualized depending on the continuous assessment and the resources available to provide neurorehabilitation including constraint-induced movement therapy and task-specific interventions.
6. Once stroke victims have enough strength in the lower limbs, cardiorespiratory fitness should be sought after.
7. Post-discharge rehabilitation care plan should be taught to and discussed with caregivers focusing on home-based rehabilitation.
8. Rehabilitation referral should be communicated with the nearest health facility to patients' address.

Acknowledgments:

We are immensely grateful to the expert reviewers for their time, valuable contributions and critical appraisal of the document:

Dr. Michael A. De Georgia, MD, FACP, FAHA, FCCM

Professor of Neurology
Case Western Reserve University School of Medicine
Director, Reinberger Neuroscience Intensive Care Unit
University Hospitals Case Medical Center
Cleveland, Ohio, USA

Dr. Michael Diringer, MD, FCCM, FAHA

Professor of Neurology
Head of Neurocritical Care
Washington University School of Medicine
St. Louis, Missouri, USA

Dr. Jai Jai Shiva Shankar, DM, MSc, FRCPC

Associate Professor of Radiology-Neuroradiology
Queen Elizabeth II Health Sciences Center
Dalhousie University
Halifax, Nova Scotia, Canada

Dr. Latha Ganti, MD, MS, MBA, FACEP, FAHA

Professor of Emergency Medicine &Neurology, University of Central Florida College of Medicine,
Vice Chair for Research and Academic Affairs, UCF/HCA Emergency Medicine Residency Program of Greater Orlando
Orlando, Florida, USA

Dr. Yin Hu, MD
Neurological Surgery
Division Chief, Neurological Surgery, UH Ahuja Medical Center
Clinical Associate Professor, Neurosurgery, CWRU School of Medicine, USA

Dr. Suhail Abdulla Alrukn, MD,FRCPC.
Consultant Neurology, head of stroke program
Associate Professor, Dubai Medical Collage,

Director of Residency Program,
President of Emirates Neurology Society EMINS, UAE

Dr.Hosam Al-Jehani, MBBS, MSc, FRCSC
Assistant Professsor of Neurosurgery
Head of the Cerebrovascular Neurosurgery Unit
Consultant interventional Neuroradiology
Consultant Neurocritical care
Head, Eastern Province section of the Saudi Neurocritical care chapter
Dammam University, Saudi Arabia
McGill University, Canada

Dr. Abdulla Al-Asmi, MD, FRCP(C)
Senior Consultant Neurologist,
Head of neurology Unit, department of medicine
President of OLAE
Chairman, HMC
SQUH, Oman

Dr. Saif Al-Adawi, MD, MRCP-UK
Consultant Neurologist and Stroke Specialist,
Head of department of medicine
Nizwa hospital, Oman

Dr. Khaleel Ibraheem Al-Shaikhli, MD, FRCP
Professor of Neurology
Senior Consultant Neurologist,
Royal Hospital / Khoula hospital, Oman

Dr. Nasser Hammad Al Azri, BSc, MD, MRCS(A&E), PGCert(HCI), PGDip(HSM)
Senior Consultant Emergency Medicine
Ibri Hospital, Oman

Dr. Mustafa Y Alhinai, MD , FRCPC
Senior Consultant Emergency Medicine
Vice President Oman Medical Association
President Oman Society of Emergency Medicine
Al-Nahdha Hospital, Oman

Dr. Khalid Mohammed Salim AL Shibli, MD, ArBEM, FUOT
Senior Consultant Emergency Medicine
Suhar Hospital, Oman

References:

Definitions

1. Sacco RL, Kasner SE, Joeph P. Broderick JP, Caplan LR, Connors JJ, Culebras A, Elkind MSV, George MG, Hamdan AD, Higashida RL, et al. An Updated Definition of Stroke for the 21st Century: A statement for healthcare professionals from the American Heart Association/American Stroke Association Stroke. 2013; 44:2064-2089. https:// doi: 10.1161/STR.0b013e318296aeca

ED Protocol

2. American Heart Association. http://www.strokeassociation.org/STROKEORG/WarningSigns/Learn-More-Stroke-Warning-Signs-and Symptoms_UCM_451207_Article.jsp#.We8KbYZx28p. Accessed Oct 24, 2017.

3. Government of South Australia. Statewide Stroke Clinical Network. Stroke Management Procedures & Protocols: A Guide for Stroke Units and Emergency Departments. Oct 14, 2014. http://www.sahealth.sa.gov.au/wps/wcm/connect/ae53950047066243b403fc22d29d99f6/Clinical+Guideline_Stroke+Management_Proceudres+and+Protocols_final+Oct14.pdf?MOD=AJPERES. Accessed Oct 24, 2017.

4. Nor AM, Davis J, Sen B, Shipsey D, Louw SJ, Dyker AG, Davis M, Ford GA. The Recognition of Stroke in the Emergency Room (ROSIER) scale: development and validation of a stroke recognition instrument. Lancet Neurol. 2005; 4(11):727-34. https://doi.org/10.1016/S1474-4422(05)70201-5

5. Casaubon LK, Boulanger JM, Blacquiere D, Boucher S, Brown K, Goddard R, Gordon J, et al. Canadian Stroke Best Practice Recommendations: Hyperacute Stroke Care Guidelines, Update 2015. World Stroke Organization. 2015; 10:924–940.

Thrombolysis Protocol

6. Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM, Khatri P, McMullan PW Jr, Qureshi AI, et al. Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2013; 44:870-947. https://doi: 10.1161/STR.0b013e318284056a.

7. Bernat JL, Beresford HR, Earnest MP, Goldblatt D, Mackin GA, McQuillen MP, Nelson RF, et al. Consent issues in the management of cerebrovascular diseases: A position paper of the American Academy of Neurology Ethics and Humanities Subcommittee. Neurology. 1999;53:9–11

8. Heidbuchel H, Verhamme P, Alings M, Antz M, Hacke W, Oldgren J, Sinnaeve P, Camm AJ, Kirshhof P, et al. EHRA Practical guide on the use of new oral anticoagulants in patients with non-valvular atrial fibrillation: executive summary. European Heart Journal. 2013;34(27):2094-2106. https://doi.org/10.1093/eurheartj/eht134

9. Yaghi S, Willey JZ, Cucchiara B, Goldstein JN, Gonzales NR, Khatri P, Kim LJ, Mayer SA, Sheth KN, Schwamm LH. Treatment and outcome of hemorrhagic transformation after intravenous alteplase in acute ischemic stroke: a scientific statement for healthcare professionals from the American heart association/American stroke association. Stroke. 2017;48(12):e343-61.

Mechanical Thrombectomy

10. Campbell BC, Donnan GA, Lees KR, Hacke W, Khatri P, Hill MD, Goyal M, Mitchell PJ, Saver JL, Diener HC, Davis SM. Endovascular stent thrombectomy: the new standard of care for large vessel ischaemic stroke. The Lancet Neurology. 2015 Aug 1;14(8):846-54.

11. Furlan AJ. Endovascular therapy for stroke–it's about time. N Engl J Med. 2015 Apr 17;372(24):2347-9.

12. Cohen DL, Kearney R, Griffiths M, Nadesalingam V, Bathula R. Around 9% of patients with ischaemic stroke are suitable for thrombectomy. BMJ. 2015 Aug 28;351:h4607.

13. Berkhemer OA, Fransen PS, Beumer D, Van Den Berg LA, Lingsma HF, Yoo AJ, Schonewille WJ, Vos JA, Nederkoorn PJ, Wermer MJ, van Walderveen MA. A randomized trial of intraarterial treatment for acute ischemic stroke. New England Journal of Medicine. 2015 Jan 1;372(1):11-20.

14. Fransen PS, Beumer D, Berkhemer OA, Van Den Berg LA, Lingsma H, van der Lugt A, van Zwam WH, van Oostenbrugge RJ, Roos YB, Majoie CB, Dippel DW. MR CLEAN, a multicenter randomized clinical trial of endovascular treatment for acute ischemic stroke in the Netherlands: study protocol for a randomized controlled trial. Trials. 2014 Dec;15(1):343.

15. Campbell BC, Mitchell PJ, Yan B, Parsons MW, Christensen S, Churilov L, Dowling RJ, Dewey H, Brooks M, Miteff F, Levi C. A multicenter, randomized, controlled study to investigate EXtending the time for Thrombolysis in Emergency Neurological Deficits with Intra-Arterial therapy (EXTEND-IA). International Journal of Stroke. 2014 Jan;9(1):126-32.

Acute Ischemic Stroke

16. Bushnell C, Gustavo Saposnik G. Evaluation and management of cerebral venous thrombosis. Continuum 2014; 20(2):335-351. https://doi: 10.1212/01.CON.0000446105.67173.a8

17. Ferro JM, Canhão P. Cerebral venous sinus thrombosis: update on diagnosis and management. Curr Cardiol Rep 2014; 16 (9):523. https://doi.org/10.1007/s11886-014-0523-2

18. Ferro JM, Bousser MG, Canhao P, Coutinho JM, Crassard I, Dentalie F, di Minnof M, Mainoh A, Martinellih I, Masuhri F, de Sousaa DA, Stam J, for the European Stroke Organization. European Stroke Organization Guideline for the diagnosis and treatment of cerebral venous thrombosis – endorsed by the European Academy of Neurology. European Journal of Neurology 2017; 24:1203–1213. https://doi:10.1111/ene.13381.

19. Walter N. Kernan, Bruce Ovbiagele, Henry R. Black, Dawn M. Bravata, Marc I. Chimowitz, Michael D. Ezekowitz, Margaret C. Fang, Marc Fisher, Karen L. Furie, Donald V. Heck, S. Claiborne (Clay) Johnston, Scott E. Kasner, Steven J. Kittner, Pamela H. Mitchell, Michael W. Rich, DeJuran Richardson, Lee H. Schwamm, John A. Wilson and on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Peripheral Vascular Disease. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014 Jul;45(7):2160-236. doi: 10.1161/STR.0000000000000024.

20. Knoflach M, Lang W, Seyfang L, Fertl E, Oberndorfer S, Daniel G, et al J; Austrian Stroke Unit Collaborators. Predictive value of ABCD2 and ABCD3-I scores in TIA and minor stroke in the stroke unit setting. Neurology. 2016 Aug 30;87(9):861-9. doi: 10.1212/WNL.0000000000003033.

21. Saposnik G, Barinagarrementeria F, Brown RD, Bushnell CD, Cucchiara B, Cushman M, deVeber G, Ferro JM, Tsai FY. Diagnosis and management of cerebral venous thrombosis: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke 2011; 42:1158-1193. https://doi.org/10.1161/STR.0b013e31820a8364.

22. Heart and Stroke Foundation of Canada. Revised Canadian Stroke Best Practice Recommendations (CSBPR) for the Secondary Prevention of Stroke. http://www.strokebestpractices.ca. Accessed Oct 24, 2017.

ICH Protocol

23. Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM, et al.; On behalf of the American Heart Association Stroke Council; Council on Cardiovascular Nursing; Council on Peripheral Vascular Disease; Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013; 44:870–947. https://doi:10.1161/STR.0b013e318284056a.

24. Hemphill JC, Greenberg SM, Anderson CS, Becker K, Bendok BR, Cushman M, Fung GL, Goldstein JN, et al. Guidelines for the Management of Spontaneous Intracerebral Hemorrhage A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2015; 46: 2032-2060. https://doi: 10.1161/STR.0000000000000069.

25. Nyquist P, Bautista C, Jichici D, Burns J, Chhangani S, DeFilippis M, et al. Prophylaxis of Venous Thrombosis in Neurocritical Care Patients: An Evidence-Based Guideline: A Statement for Healthcare Professionals from the Neurocritical Care Society. Neurocrit Care (2016) 24:47–60. DOI 10.1007/s12028-015-0221-y

26. Frontera JA, Lewin JJ 3rd, Rabinstein AA, Aisiku IP, Alexandrov AW, Cook AM, et al. Guideline for Reversal of Antithrombotics in Intracranial Hemorrhage: A Statement for Healthcare Professionals from the Neurocritical Care Society and Society of Critical Care Medicine. Neurocrit Care. 2016 Feb;24(1):6-46. doi: 10.1007/s12028-015-0222-x.

27. Hemphill III JC, Bonovich DC, Besmertis L, Manley GT, Johnston SC. The ICH score: A simple, reliable grading scale for intracerebral hemorrhage. Stroke. 2001; 32(4): 891-897. https://doi.org/10.1161/01.STR.32.4.891

28. Kamel H, Hemphill III JC. Characteristics and sequelae of intracranial hypertension after intracerebral hemorrhage. Neurocritical Care 2012; 17:172-176. https://doi.org/10.1007/s12028-012-9744-7

29. Mendelow AD, Gregson BA, Rowan EN, Murray GD, Gholkar A, Mitchell PM, for the STICH II Investigators. Early surgery versus initial conservative treatment in patients with spontaneous supratentorial lobar intracerebral haematomas (STICH II): A randomized trial. Lancet 2013; 382: 397–408. https://doi.org/10.1016/S0140-6736(13)60986-1.

30. Greenberg MS. Handbook of Neurosurgery, 8th ed. New York, USA: Thieme, 2016. Pp. 1118-1330.

31. Win H. Youmans and Winn Neurological Surgery, 7th ed. Philadelphia, USA: Elsevier, 2016. P. 10498.

Appendix I: ROSIER Scale

ROSIER Scale

Assessment Date ☐☐☐☐☐☐ Time ☐☐☐☐

Symptom onset Date ☐☐☐☐☐☐ Time ☐☐☐☐

GCS E = ☐ M = ☐ V = ☐ BP ☐☐ *BM ☐☐

**if Blood Glucose <3.5 mmol/L treat urgently and reassess once blood glucose normal*

Has there been loss of consciousness or syncope?	Y (-1) ☐	N (0) ☐
Has there been seizure activity?	Y (-1) ☐	N (0) ☐

Is there a NEW ACUTE onset (or on awakening from sleep)

i.	Asymmetric facial weakness	Y (+1) ☐	N (0) ☐
ii.	Asymmetric arm weakness	Y (+1) ☐	N (0) ☐
iii.	Asymmetric leg weakness	Y (+1) ☐	N (0) ☐
iv.	Speech disturbance	Y (+1) ☐	N (0) ☐
v.	Visual field defect	Y (+1) ☐	N (0) ☐

*Total Score _____ (-2 to +5)

Provisional diagnosis

☐ Stroke ☐ Non-Stroke (specify) _____

**Stroke is unlikely but not completely excluded if total scores are equal to or less than 0*

Appendix II: The National Institutes of Health Stroke Scale (NIHSS)

NIH stroke scale

Admission date: **Time:**

				Before	2 h	24 h	7D/ Disch
1a.Level of consciousness	0	Alert					
	1	Not alert, but arousable with minimal stimulation					
	2	Not alert, requires repeated stimulation to attend					
	3	Coma					
1b. LOC questions *Ask patient the month and their age*	0	Answers both correctly					
	1	Answers one correctly					
	2	Both incorrect					
1c. LOC commands *Ask patient to open/close eyes and form/release fist*	0	Obeys both correctly					
	1	Obeys one correctly					
	2	Both incorrect					
2.Best gaze *Only horisontal eye movement*	0	Normalt					
	1	Partial gaze palsy					
	2	Forced gaze palsy					
***3.* Visual field testing**	0	No visual field loss					
	1	Partial hemianopia					
	2	Complete hemianopia					
	3	Bilateral hemianopia (blind, incl. Cortical blindness)					
4. Facial palsy *Ask patient to show teeth or raise eyebrows and close eyes tightly*	0	Normal symmetrical movemeent					
	1	Minor paralysis (flattened nasolabial fold, asymmetry on smiling)					
	2	Partial paralysis (total or near total paralysis of lower face)					
	3	Complete paralysis of one or both sides (abscence of facial movement in the upper and lower face)					
5. Motor function arm	0	Normal (extends arm 90° or 45° for 10 sec without drift)	**Right**				
	1	Drift					
	2	Some effort against gravity					
	3	No effort against gravity	**Left**				
	4	No movement					
	9	Untestable (joint fused/limb amputated) *(do not add score)*					
6. Motor function leg	0	Normal (holds leg in 30° position for 5 sec without drift)	**Right**				
	1	Drift					
	2	some effort against gravity					
	3	No effort against gravity	**Left**				
	4	No movement					
	9	Untestable (joint fused/limb amputated) *(do not add score)*					
7. Limb ataxia	0	No ataxia					
	1	Present in one limb					
	2	Present in two limbs					
8. Sensory *Use pinprick to test arms, legs, trunk and face, compare side to side*	0	Normal					
	1	Mild to moderate decrease in sensation					
	2	Severe to total sensory loss					
9. Best language *Ask patient to describe picture, name items*	0	No aphasia					
	1	Mild to moderate aphasia					
	2	Severe aphasia					
	3	Mute					
10. Dysarthria *Ask patient to read several words*	0	Normal articulation					
	1	Mild to moderate slurring of words					
	2	Near unintelligible or unable to speak					
	9	Intubated or other physical barrier *(do not add score)*					
11. Extinction and inattention *Use visual double stimulation or sensory double stimulation*	0	Normal					
	1	Inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities					
	2	Hemi-inattention, severe or to more than one modality					
12. Distal motor function *Ask patient to extend his/her fingers as much as possible*	0	Normal	**Right**				
	1	At least some extension after 5 sec but not fully extended					
	2	No voluntary extention after 5 sec	**Left**				
		Total score:					

Category	Score/Description		Date/Time Initials	Date/Time Initials	Date/Time Initials
1a. **Level of Consciousness** (Alert, drowsy, etc.)	0 = Alert 1 = Drowsy 2 = Stuporous 3 = Coma				
1b. **LOC Questions** (Month, age)	0 = Answers both correctly 1 = Answers one correctly 2 = Incorrect				
1c. **LOC Commands** (Open/close eyes, make fist/let go)	0 = Obeys both correctly 1 = Obeys one correctly 2 = Incorrect				
2. **Best Gaze** (Eyes open - patient follows examiner's finger or face)	0 = Normal 1 = Partial gaze palsy 2 = Forced deviation				
3. **Visual Fields** (Introduce visual stimulus/threat to pt's visual field quadrants)	0 = No visual loss 1 = Partial Hemianopia 2 = Complete Hemianopia 3 = Bilateral Hemianopia (Blind)				
4. **Facial Paresis** (Show teeth, raise eyebrows and squeeze eyes shut)	0 = Normal 1 = Minor 2 = Partial 3 = Complete				
5a. **Motor Arm - Left** 5b. **Motor Arm - Right** (Elevate arm to 90° if patient is sitting, 45° if supine)	0 = No drift 1 = Drift 2 = Can't resist gravity 3 = No effort against gravity 4 = No movement X = Untestable (Joint fusion or limb amp)	Left			
		Right			
6a. **Motor Leg - Left** 6b. **Motor Leg - Right** (Elevate leg 30° with patient supine)	0 = No drift 1 = Drift 2 = Can't resist gravity 3 = No effort against gravity 4 = No movement X = Untestable (Joint fusion or limb amp)	Left			
		Right			
7. **Limb Ataxia** (Finger-nose, heel down shin)	0 = No ataxia 1 = Present in one limb 2 = Present in two limbs				
8. **Sensory** (Pin prick to face, arm, trunk, and leg - compare side to side)	0 = Normal 1 = Partial loss 2 = Severe loss				
9. **Best Language** (Name item, describe a picture and read sentences)	0 = No aphasia 1 = Mild to moderate aphasia 2 = Severe aphasia 3 = Mute				
10. **Dysarthria** (Evaluate speech clarity by patient repeating listed words)	0 = Normal articulation 1 = Mild to moderate slurring of words 2 = Near to unintelligable or worse X = Intubated or other physical barrier				
11. **Extinction and Inattention** (Use information from prior testing to identify neglect or double simultaneous stimuli testing)	0 = No neglect 1 = Partial neglect 2 = Complete neglect				
	TOTAL SCORE				

Appendix III: Inclusion and Exclusion Criteria for IV rt-PA in Acute Ischemic Stroke

	YES	NO
Inclusion Criteria		
A clinical diagnosis is made of ongoing acute cerebral ischemia which is resulting in a potentially disabling deficit		
• The onset of symptoms was within 4.5 hours from presentation		
• The patient is aged 18 years or older		
Absolute Exclusion Criteria		
Hemorrhage on head CT		
Hypodensity greater than one-third of a cerebral hemisphere demonstrated on head CT		
Active internal bleeding		
History of previous intracranial hemorrhage		
Intracranial neoplasm, arteriovenous malformation, or aneurysm		
Significant head trauma or prior stroke within 3 months		
Recent intracranial or intraspinal surgery		
Infective endocarditis as the cause of cerebral embolism		
Platelet count < 100,000/mm3		
Abnormally elevated aPTT above the upper limit of bormal		
INR > 1.7 or PT > 15 seconds.		
Current use of direct thrombin of factor Xa inhibitors within 48 hours or if a sensitive laboratory test remains elevated (e.g., aPTT, INR, ECT, TT, or factor Xa assay)		
Severely elevated blood pressure (defined as > 185/110 mmHg)+		
Blood glucose concentration < 50 mg/dL +		
Relative Exclusion Criteria*		

Pregnancy		
Major surgery or serious trauma within the previous 14 days		
Recent gastrointestinal or urinary tract hemorrhage within 21 days		
Minor or rapidly improving symptoms (resolving spontaneously)		
Seizure at onset with postictal residual impairments		
Recent acute myocardial infarction within 3 months		
Arterial puncture at a noncompressible site within 7 days		
Symptoms suggestive of subarachnoid hemorrhage		
Relative Contraindications to Extend the Treatment Window to 4.5 hours#		
Age older than 80 years		
NIHSS > 25		
Any anticoagulant usage regardless of coagulation study results		
The patient has both diabetes mellitus and a history of previous stroke		

+ IV thrombolysis may be administered if these vital sign disturbances can be corrected within an appropriate time window.

* Depending on the clinical circumstances, with careful consideration of the risks and benefits, patients may receive IV thrombolysis despite 1 or more of these relative contraindications.

These relative contraindications are based on the ECASS III trial exclusionary criteria. Depending on the clinical circumstances, with careful consideration of the risks and benefits, patients may receive IV thrombolysis despite 1 or more of these relative contraindications during an extended time window.

CT = computed tomography; aPTT = activated partial thromboplastin time; INR = international normalized ratio; PT = partial thromboplastin time; ECT = ecarin clotting time; TT = thrombin time; NIHSS = National Institutes of Health Stroke Scale

Appendix IV: IV rt-PA Dosing Table and Example (based on reconstituted concentration of 1 mg/ml)

Weight (kg) (approximate to nearest 5kg)	Total dose (mg) (dose = 0.9mg/kg) MAX DOSE: 90mg	rt-PA bolus dose volume (mL) (bolus = 10% of total)	rt-PA infusion dose volume (mL) (infusion = 90% of total)	Total infusion volume (mL) (approximate)
100+	90.0	9.0	81.0	131
95	85.5	8.5	77.0	127
90	81.0	8.1	72.9	123
85	76.5	7.6	68.9	119
80	72.0	7.2	64.8	115
75	67.5	6.7	60.8	111
70	63.0	6.3	56.7	107
65	58.5	5.8	52.7	103
60	54.0	5.4	48.6	99
55	49.5	4.9	44.6	95
50	45.0	4.5	40.5	91
45	40.5	4.0	36.5	87
40	36.0	3.6	32.4	82
Patients > 55kg will require 50mg and 10mL vials.		**Bolus dose is given as an IV push over 1 minute.**	**Add to 50mL sodium chloride 0.9% minibag.**	**Infuse over 60 minutes until empty via volume control pump.**

Example:

1. Patient weighs 84 kgs - total dose of rt-PA required = 75.6 ml.

2. Mix one 50 mg vial with 50 ml sterile water.

3. Mix three 10 mg vials each with 10 ml sterile water.

4. Using a 10 ml syringe draw up 7.6 ml of rt-PA (10% of the dose as a bolus). The remainder is 68 ml.

5. Using a 60 ml syringe number 1 draw up 34 ml of rt-PA (half of remainder solution).

6. Using a 60ml syringe number 2 draw up 34mls of rt-PA (the other half of remainder solution).

7. Set the syringe pump to infuse at 68 ml per hour.

8. Each syringe will take 30 minutes to infuse.

For a 70kg patient

Total dose = 0.9mg/kg bodyweight

= 0.9 x 70 = 63mg rtPA

Bolus dose = 10% of total dose

= 0.1 x 63 = 6.3mg = 6.3mL⇒ give as IV push over 1 minute

Infusion dose = total dose minus bolus dose

= 63 - 6.3 = 56.7mg = 56.7mL, add to 50mL sodium chloride 0.9% minibag ⇒ infuse over 60 minutes.

Appendix V: Nurse Observation and task schedule post-IV rt-PA administration

Time	Activity
0 hrs	Apply telemetry monitoring equipment Administer rt-PA bolus and commence infusion as per protocol
0-1 hrs	-Write timetable for observations on chart -15 minutely observation: -modified NIHSS (mNIHSS), BP, Pulse, SpO2, Temperature -Assess size and shape of tongue. Observe for signs of allergy: unilateral or bilateral tongue enlargement, rash or redness, coughing, lip, face swelling. -Nil by mouth – commence 0.9 % sodium chloride intravenous fluids -Hourly Fluid Balance Chart -Strict Bed Rest -Avoid invasive therapies (including thrombo embolic deterrent (TED) stockings) -Internal and external bleeding assessment
1-2 hrs	-15 minutely observation: mNIHSS, BP, Pulse, SpO2, Temperature -Assess size and shape of tongue. Observe for signs of allergy unilateral or bilateral tongue enlargement, rash or redness, coughing, lip, face swelling. -Hourly Fluid Balance Chart -Strict Bed Rest; Safety Precautions: falls prevention, pressure area care -If required blood glucose 2 hourly (ongoing) -Internal/external bleeding assessment
2-6 hrs	-30 minutely observation: mNIHSS, BP, Pulse, SpO2, Temperature -Hourly Fluid Balance Chart -Strict Bed Rest; Safety Precautions: falls prevention, pressure area care -Internal/external bleeding assessment
6-12 hrs	-Hourly observation: mNIHSS, BP, Pulse, SpO2, Temperature -Hourly Fluid Balance Chart -Strict Bed Rest; Safety Precautions: falls prevention, pressure area care -Internal/external bleeding assessment -Commence Sequential Compression Device, plus or minus thigh length TED stockings
12-24 hrs	-Two hourly observation: mNIHSS, BP, Pulse, SpO2, Temperature -Hourly Fluid Balance Chart -Patient can sit out of bed if able / Physiotherapy review if available -Swallow screen assessment -Nasoenteric tube feeding can be inserted if required. -Internal/external bleeding assessment

Appendix VI: Modified Rankin Scale (MRS)

MRS is a commonly used scale for measuring the degree of disability or dependence in the daily activities of people who have suffered a stroke or other causes of neurological disability.

Score	Description
0	No symptoms at all
1	No significant disability despite symptoms; able to carry out all usual duties and activities
2	Slight disability; unable to carry out all previous activities, but able to look after own affairs without assistance
3	Moderate disability; requiring some help, but able to walk without assistance
4	Moderately severe disability; unable to walk without assistance and unable to attend to own bodily needs without assistance
5	Severe disability; bedridden, incontinent and requiring constant nursing care and attention
6	Dead

Appendix VII: ICH score

A routine part of the evaluation should include a standardized severity score, because such scales can help streamline assessment and communication between providers. Although the optimal severity scale is not yet clear, the most widely used and externally validated is the ICH Score.

ICH Score

Clinical or Imaging Factor	Point Score
GCS	
3-4	2 points
5-12	1 point
13-15	0 points
ICH Volume	
≥30 cm^3	1 point
< 30 cm^3	0 points
Intraventricular Hemorrhage	
Yes	1 point
No	0 points
Infratentorial Origin of ICH	
Yes	1 point
No	0 points
Age	
≥80 years	1 point
< 80 years	0 points
Total Score	**0-6 points**

Mortality rate based on ICH Score

ICH Score	Mortality rate
0 points	0%
1 point	13%
2 points	26%
3 points	72%
4 points	97%
5 points	100%
6 points	100%

Appendix VIII: IV rt-PA Checklist Forms

Form A. Initial Assessment Form

Date		
Time of Symptoms Onset		
Time Last Seen Normal		
Time of Arrival/Triage		
Patient presents with disabling neurologic deficit (FAST)?	Yes	No
Time stroke code activation	Hour	Minute
Imaging shows no evidence of bleed and meets 6 h window?	Yes	No
	Hour	Minute
Time Patient sent to CT/ CTA/ CT Perfusion		
Departure from CT room		
Neurologist/Physician notified		
Neurologist/Physician arrival		
Neurointervention team notified		
Neurosurgery team notified (if required)		
CT shows no evidence of bleed or established infarct and meets 4.5 hours window for IV thrombolysis	Yes	No
Patient does not meet rt-PA eligibility criteria	Reason (tick applicable)	
	Not ischemic stroke	
	Stroke too severe	
	Family/patient refused	
	Patient palliative status	
	LSN time > 4.5 hours	
	Stroke too mild	
	Contraindication	
	MD decision	
Patient eligible for thrombectomy (6 hours window)?	Yes	No (Reason)

Final stroke management pathway	Tick applicable
Acute ischemic stroke for tPA	
Acute ischemic stroke for tPA/ thrombectomy	
Acute ischemic stroke for thrombectomy	
Acute ischemic stroke neither for tPA nor thrombectomy	

ED Physician Name (print): _____Signature: _____

Staff Number: _____ Time: hr_____min_____

Neurologist Name (print): _____Signature: _____

Staff Number: _____ Time: hr_____min_____

Form B. ED Stroke protocol checklist

Task	YES	NO	Remarks
Stroke symptoms recognized			
Stroke mimic ruled out- check finger glucose			
Time of onset identified (< 6 hours)			
Patient assigned category 2 triage level			
Patient immediately transferred to resuscitation room			
Senior ED doctor immediately notified			
Senior Emergency Department Doctor and Nurse			
Acute stroke confirmed within window			
Assessed vital signs and resuscitated			
Code stroke activated			
Emergent CT ordered			
Oxygen supplementation provided (Target oxygen saturation > 95%)			
Two large bore IV inserted in each cubital vein			
URGENT bloods ordered (Full blood examination, Electrolytes, Glucose, Liver function tests, Coagulation profile, Troponin			
Determined and documented weight			
Senior Neurology Doctor and Stroke Nurse			
Confirmed history with patient and/or EMS, family, witnesses or general practitioner with particular reference to: Stroke onset time, Medical history, Advance care directive , Medication			
Calculated National Institute of Health Stroke Scale (NIHSS)			
Completed the checklist of inclusion/exclusion criteria for intravenous rt-PA			
Identified any potential bleeding source			
Assessed vital signs every 15 minutes			
Ensured ED Officer/Nurse responsibilities are completed			
Obtained and document all results (i.e. CXR, ECG, blood tests, vital signs)			
Notified Stroke Consultant			
Assisted and supervised patient during transfer to radiology			
Ensured hospital bed manager arranged bed			
Obtained verbal consent for intravenous rt-PA (if applicable)			
Actioned treatment specific protocols as recommended by Stroke Consultant			

Form C. Thrombolysis Protocol checklist

Task	Yes	No	Remarks
Confirmed history with patient and/or EMS, family, witnesses or general practitioner with particular reference to stroke onset time, medical history, advance care directive and medication			
Performed full neurological exam and calculate National Institute of Health Stroke Scale (NIHSS)			Calculated NIHSS
Completed the checklist of inclusion/exclusion criteria for intravenous rt-PA			
Identified any potential bleeding source			
Assessed vital signs every 15 minutes			
Ensured ED Officer/Nurse responsibilities are completed			
Obtained Chest X-ray			
Obtained and document all results (i.e. ECG, blood tests, vital signs)			
Assisted and supervise patient during transfer to radiology			
Reviewed CT brain with radiologist to rule out hemorrhage, major hypodensity, or other lesion that would contraindicate rt-PA			
Ensured hospital bed manager arranged bed			
Obtained verbal consent for intravenous rt-PA (if applicable)			
Immediately discussed with stroke/neurology consultant (If certain that benefit to harm ratio of rt-PA favours thrombolysis, administer as per Thrombolysis Protocol)			
Ensured eligibility for endovascular intervention (refer to Mechanical Thrombectomy protocol)			
Lowered BP to below 180/110 mm Hg, before given rt-PA and insure stabilization of BP level below this range during and after rt-PA infusion (refer to BP management chart)			
Corrected hypotension with IV fluids and vasopressors aggressively			
Counseled of patient and family			
Did not delay thrombolysis for catheterisation, NGT insertion or other procedures.			

Form D. Post-Thrombolysis Care checklist

Task	Yes	No	Remarks
Admitted the patient to an ICU (1:1) or stroke unit (1:2) for monitoring			
Patient monitored by a specialist nurse for the first 24 hours			
Performed neurological assessments and monitored GCS and blood pressure post rt-PA at the following intervals: o Every 15 minutes for 2 hours o Every 30 minutes for 4 hours o Every hour until 24hours (unless otherwise directed by treating physician).			
Observed for severe headache, acute hypertension, nausea or vomiting			
If yes, discontinued the infusion and obtained an urgent plain brain CT scan			
Repeated brain CT at 24 hours to assess for asymptomatic haemorrhage and to allow initiation of anti-platelet therapy			
Delayed placement of intra-arterial line (no punctures of arteries or large veins within 24 hours after starting rt-PA)			
Avoided insertion Nasogastric tube (avoid insertion until 8 -24 hours post rt-PA infusion)			
Avoided insertion Foley's catheter (no bladder catheterisation within 90 minutes of completing rt-PA).			
Increased the frequency of blood pressure measurements if systolic blood pressure >180 mmHg or diastolic blood pressure of >110 mmHg. Administered antihypertensive medications to maintain blood pressure at or below these levels.			
Considered transfer to ICU for intra-arterial blood pressure monitoring and management if systolic still exceeded 180 mmHg, or diastolic exceeded 110 mmHg after 30 minutes			
Left IV cannula in situ for blood collection. If emergency venepuncture required, applied direct pressure to the site for 20 minutes			
Watched for allergic reaction, tongue swelling and bleeding from any site			
Did not initiate anti-platelet therapy or anticoagulation within 24 hours after starting rt-PA			
Commenced blood glucose monitoring for 8 hours post rt-PA infusion			
Avoided mobilisation (including toilet use) after rt-PA for 24 hours			
Early assessment for dysphagia and Speech			

Form E. Management of Complications (oro-lingual angioedema) checklist

Task	Yes	No	Remarks
Considered stopping rt-PA immediately			
Administered oxygen 2-4 l/min and maintain $SpO_2 > 94\%$			
Monitored the airway, checked for stridor, prepared for possibility of intubation or cricothyrodotomy.			
Administered Chlorpheniramine10-20 mg IV followed by Ranitidine 50 mg IV			
If tongue continued to enlarge after the above steps have been completed then administered Methylprednisolone (Solu-Medrol) 80-100 mg IV			
If the oro-lingual angioedema did not halt at this point, then urgently: o Administered Epinephrine 1:10000.3 ml subcutaneous or by nebulizer 0.5 ml. o Consulted ENT/anesthesiology or the appropriate in-house service immediately for possible emergency cricothrotomy/tracheostomy or fiberoptic-nasotracheal intubation if oral intubation fails.			

Form F. Management of Anaphylaxis checklist

Task	Yes	No	Remarks
Considered stopping rt-PA immediately			
Administered oxygen 2-4 l/min and maintain $SpO_2 > 94\%$ and monitor airway			
Administered Epinephrine 1:10000.3 ml SC or IM			
Administered Chlorpheniramine10 mg IV			
Administered Hydrocortisone 200 mg IV			
If hypotensive (BP < 90 mmHg), started fluid resuscitation 1-2 liter bolus IV Normal Saline			
Administered nebulized Salbutamol 2 mg for bronchospasm, repeated Epinephrine if no response			
Considered Epinephrine infusion 1-4 mcg/min IV if inadequate response			

Form G. Management of post-rt-PA ICH checklist

Task	Yes	No	Remarks
Stopped rt-PA infusion immediately if sudden neurologic decline occurred			
CT scan obtained emergently			
Control of hypertension (systolic target 140-160 mm Hg)			
Consulted Neurosurgery			
Reversal of the fibrinolytic effect with: 1. Cryoprecipitate (10 units) or 2. An antifibrinolytic agent (Tranexamic acid 10 mg/kg to 15 mg/kg IV over 20 minutes or 3. Aminocaproic acid 5 g IV followed by an infusion of 1 g/h if necessary). 4. Additional cryoprecipitate given if required			
Considered consulting Hematologist.			

Form H. Mechanical Thrombectomy checklist

Task	Yes	No	Remarks
Transferred eligible cases to the angiography suite immediately even if IV-rt-PA is still ongoing			
Obtained informed consent from the patient or the patient's legally authorized representative by the interventional neuro-radiologist or neurologist			
Monitored the patient in ICU (1:1) /Acute Stroke Unit (1:2 nursing care) for at least 24 hours post-procedure			
Checked femoral sheath, keep it patent by continuous pressure flush and remove it after 24 hours. • Checked BP before removing the sheath. • Placed the patient supine for 6 hours after removal the sheath with the accessed leg straight.			
Checked for bleeding/hematoma at the groin puncture site ipsilateral pedal pulse and neurological exam: o Every 15 minutes for 2 hours o Every 30 minutes for 2 hours o Every 60 minutes for the remaining 24 hours.			

Form I. IV rt-PA order form checklist

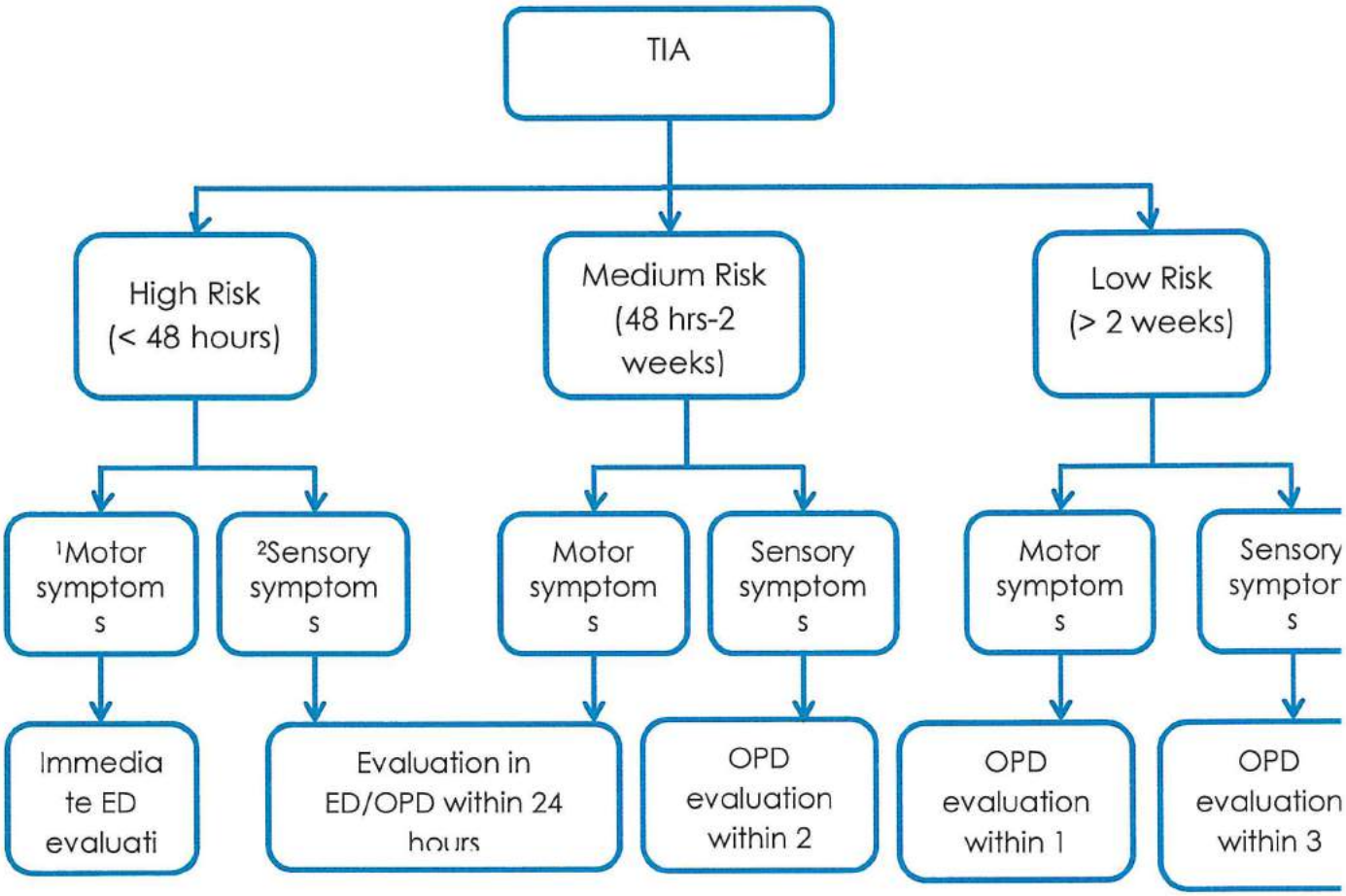
rt-PA IV Dose	Nursing	
	Time	Initial
Dose must be calculated for the patient's weight (10% of the total dose given as bolus, followed by 90& of the total dose) TOTAL dose: Patient's weight (kg) _____ X 0.9 = _____ mg IV, (maximum dose 90mg)		
BOLUS dose: 10% TOTAL dose = _____ mg IV over ONE minute. Time: _____Hr _____ Min.		
Continous infusion dose = 90% TOTAL dose = _____ mg over ONE hour Time: _____ Hr _____ Min.		
Discontinue rt-PA immediately and notify neuro-medical on-call if severe headache, decreased level of consciousness, severe bleeding occur or breathing difficulty.		
Nurse Signature & Staff no.		

Appendix IX: General Acute Stroke Audit Form

Parameter	Y	N	N/A	Comment/ time
Was stroke code initiated & time documented?				
Did a designated physician/ nurse respond to bedside within 15 minutes & was this documented?				
Were the time parameters included in the stroke assessment protocol or ED stroke protocol documented?				
Were the time parameters included in the stroke assessment protocol or ED stroke protocol met?				
Was the NIHSS done for the initial assessment as defined by organizational policy?				
Was a blood glucose level done?				
Was a neuroimaging of the head completed within 25 minutes of patient presentation with stroke symptoms?				
Was the interpretation by a radiologist completed within 10 minutes & documented?				
Were lab tests (CBC with coagulation, PT/INR, LFT, RFT & troponin) done within 45 minutes of patient presentation, if ordered?				
Was ECG done within 45 minutes of patient presentation, if ordered?				
Was actual patient weight obtained?				
If patient eligible, was the door to needle time <45 minutes?				
If patient was eligible for rt-PA and did not receive it, was the reason documented?				
Were vital signs done per order post rt-PA?				
Were neuro assessments completed per organizational policy?				
Were labs drawn, IV started, & Foley inserted, if ordered, prior to IV rt-PA being started?				
Was the time & amount of bolus dose and IV drip of rt-PA documented?				
Was the patient eligible for mechanical thrombolectomy				
If eligible, was door to femoral <60 minutes?				
Was the patient transferred to another facility and, if so, was the time documented?				
If patient admitted, was he or she admitted to an appropriate stroke ICU/ ASU or floor?				
If patient admitted, was the stroke order set implemented?				
OTHER:				

*adopted from: 2015 Joint Commission Resources

Appendix X: TIA algorithm



1 Motor: transient, fluctuating, and/or persistent unilateral weakness (face, arm, and/or leg), or speech disturbance

2 Sensory: hemibody sensory loss, acute monocular visual loss, binocular diplopia, hemivisual loss or dysmetria)

Appendix XI: Discharge from Stroke Unit Checklist

	Yes	No	As out-patient
Discharge Summary given			
Investigations completed /Scheduled			
Serial CT / MRI Head			
Extracranial artery imaging: (Carotid/vertebral CTA or MRA)			
Echocardiography			
Holter monitoring			
Fasting lipids/HbA1c (or other young stroke workup if applicable)			
	Yes	**No**	**Remarks**
Discharge advice			
Patient / Family counseled regarding Stroke prevention and Life-style modification choices			
Stroke education material given			
DVT Prophylaxis (If required)			
Referral to Rehabilitation Team			
Swallowing issues / Diet			
Language and speech assessment			
Referral to Cardiology (if indicated):			
Referral to Vascular Surgery (if indicated)			
Referral to other specialties (specify)			
Referral to local hospital/local health center			
Discharge Medication			
Antiplatelet agent: Aspirin/ Clopidogrel/ Other (specify)			
Statin			
Anti-coagulation: Warfarin/NOACs/ LMWH			
Anti-hypertensive treatment (if indicated)			
Anti-Diabetes treatment (if indicated)			
Follow-up Date in Stroke Clinic given			

Discharging physician signature:_____

Discharging nurse signature:_____