Running a stroke code

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Stroke

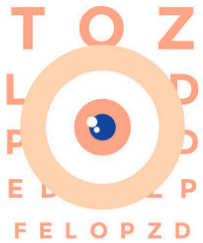
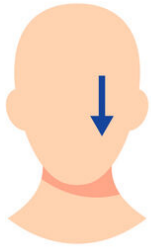
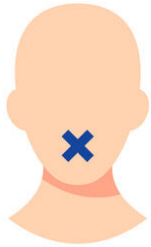
- Stroke is a sudden onset, focal neurological deficit resulting from spontaneous hemorrhage or infarction of the central nervous system with objective evidence of infarction irrespective of duration of clinical symptoms. (2009)

- **Working (clinical) definition of stroke**

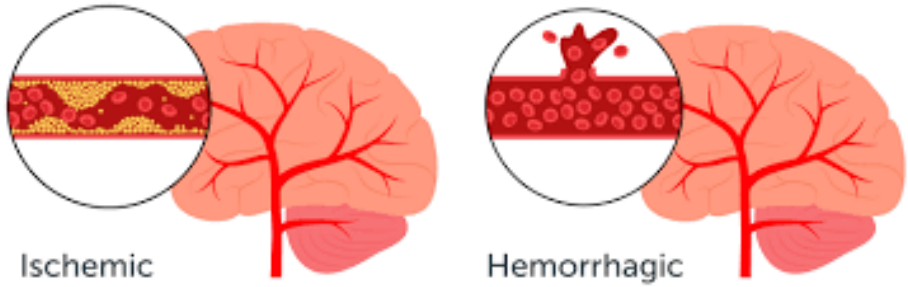
Sudden onset of focal neurological deficit (based on history or physiscal assessment).

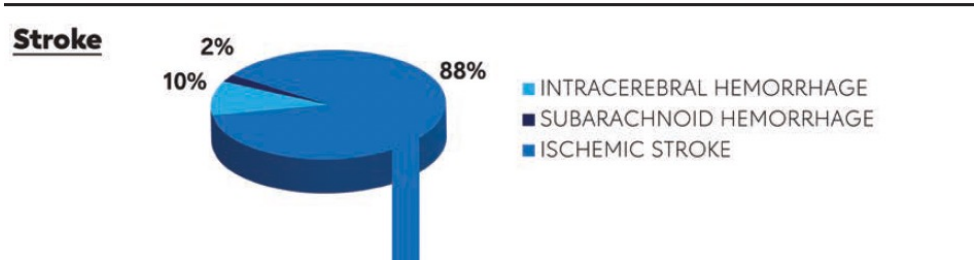
- In the hyperacute phase, clinical judgement is key because CT only rules out hemorrhage. (You may be lucky to find hyperdense MCA or loss of insular ribbon sign)

B E F A S T

BALANCE	EYES	FACE	ARM	SPEECH	TIME
					
LOSS OF BALANCE	LOST VISION	FACE DROOPING	ARM WEAKNESS	SPEECH DIFFICULTY	TIME TO CALL AN AMBULANCE

Stroke subtypes





1. Ischemic: 88% (in Africa 68-70%)

2. Hemorrhagic 12% (in Africa 30-32%)

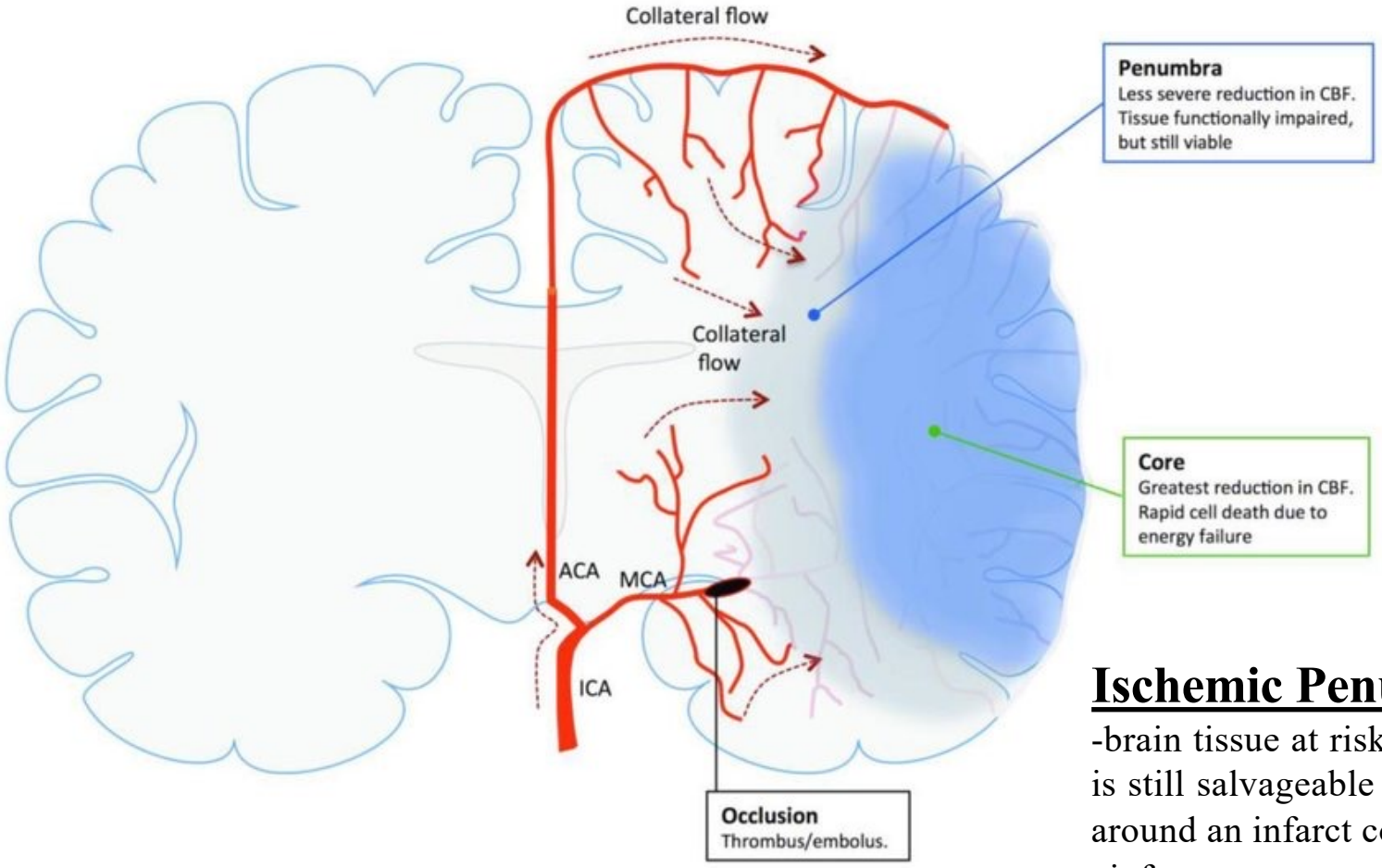
- Intracerebral hemorrhage
- subarachnoid hemorrhage

Principles of Acute ischemic stroke management

REPEFUSION THERAPY

SPECIFIC MANAGEMENT

GENERAL MEASURES

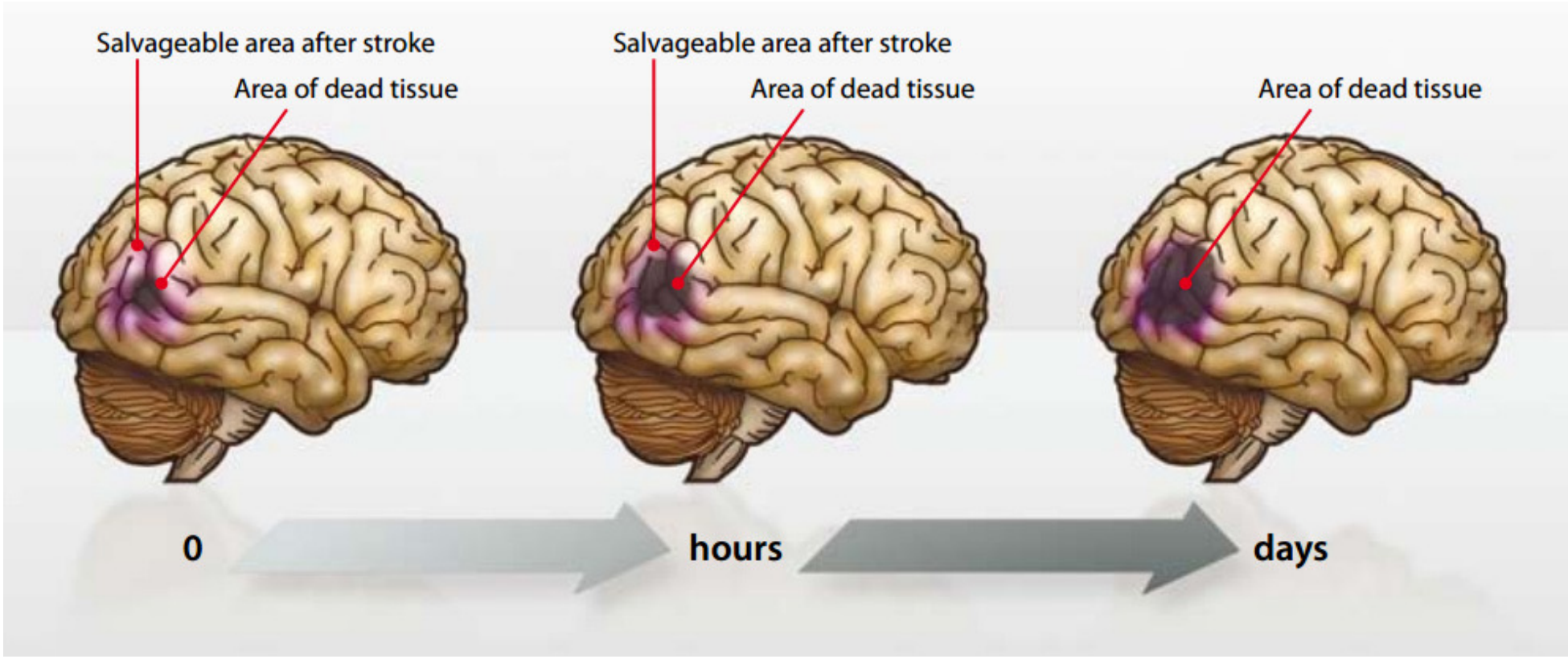


Ischemic Penumbra

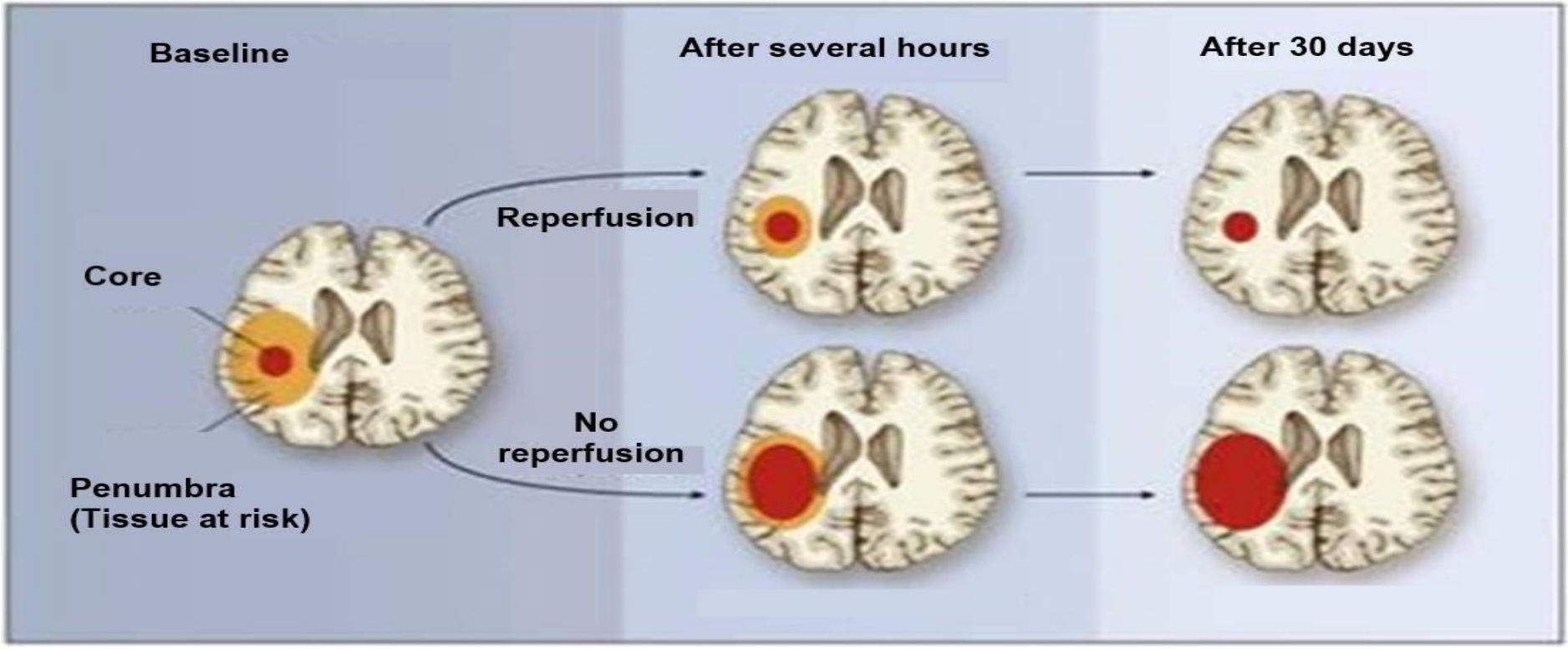
-brain tissue at risk of progressing to infarction but is still salvageable if re-perfused. generally located around an infarct core

- infarct core: represents the tissue which has already infarcted or is going to infarct regardless of reperfusion.

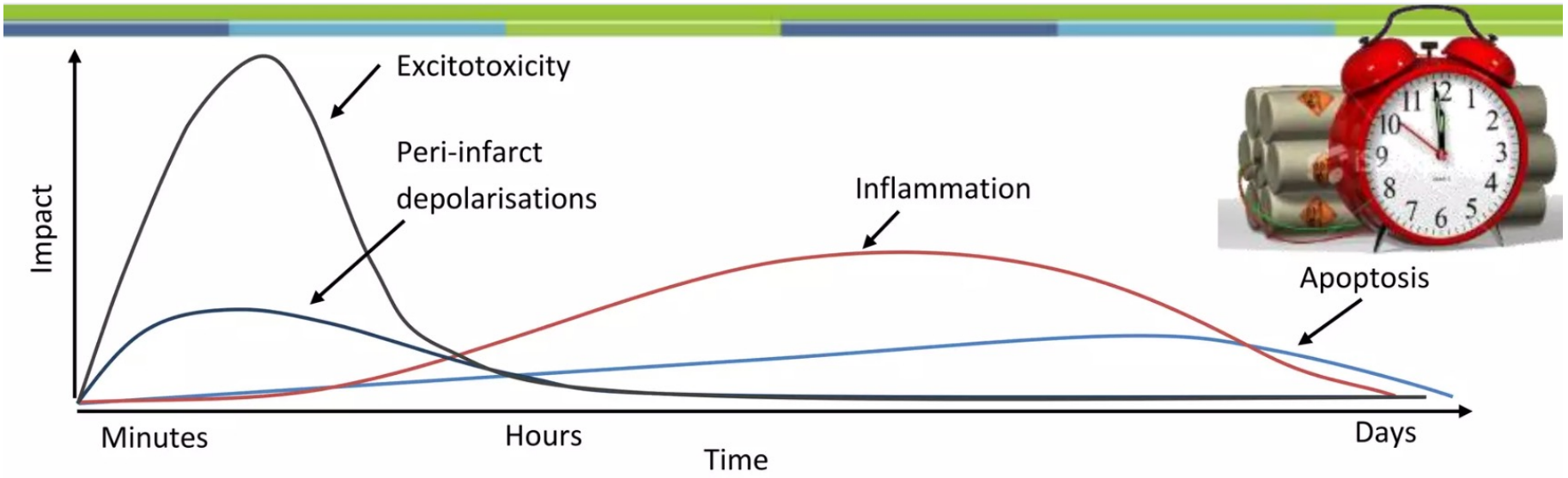
Natural History of an ischemic stroke



Rationale for rapid evaluation and treatment



(Time is of essence)



Estimated Pace of Neural Circuitry Loss In Typical Large-Vessel Supratentorial Acute Ischaemic Stroke				
	Neurons Lost	**Synapses Lost**	**Myelinated Fibres Lost**	**Accelerated Aging**
Per Stroke	1.2 billion	8.3 trillion	7140 km	36 y
Per Hour	120 million	830 billion	714 km	3.6 y
Per Minute	1.9 million	14 billion	12 km	3.1 wk
Per Second	32,000	230 million	200 m	8.7 h

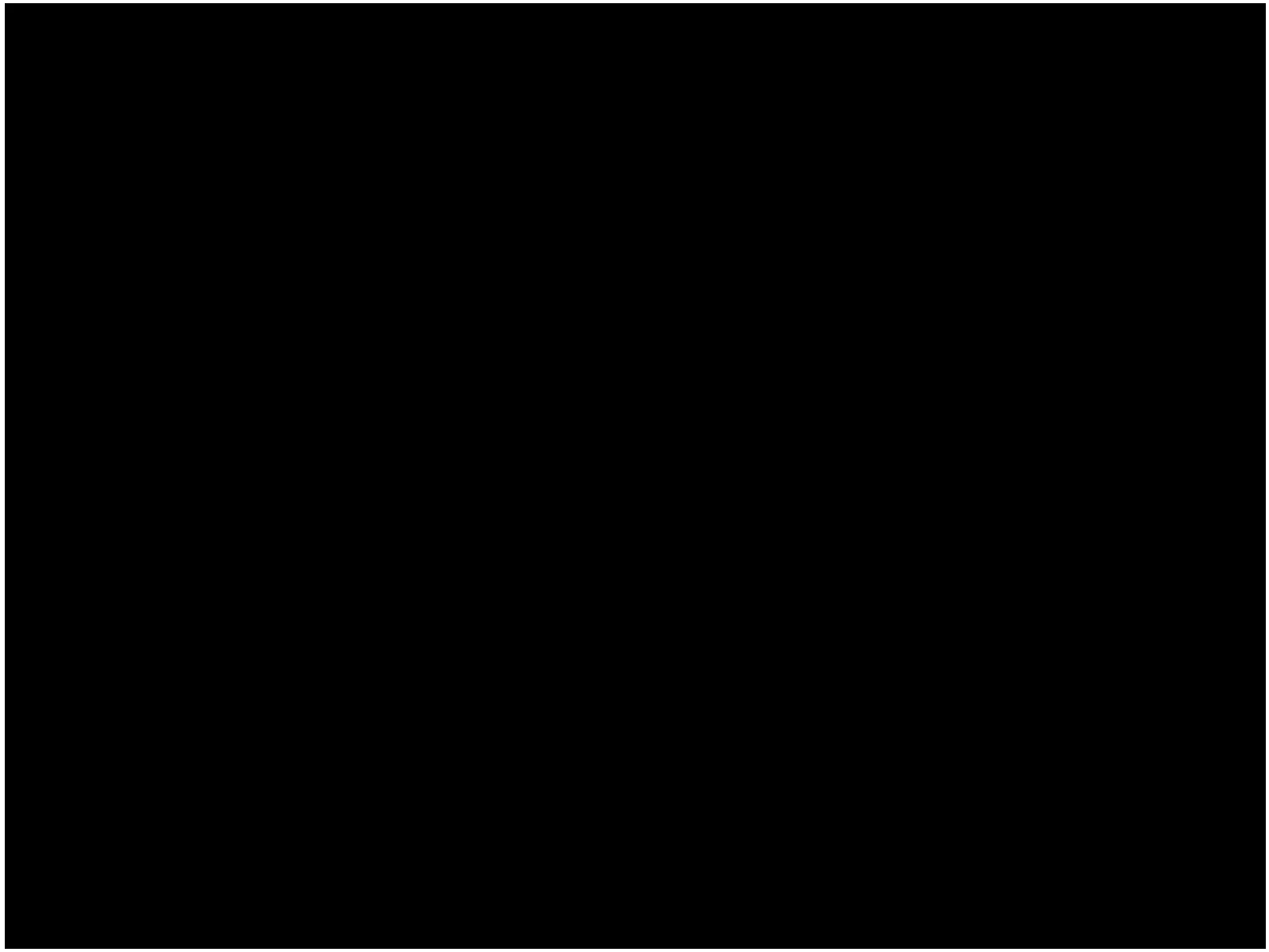
Timeline metrics

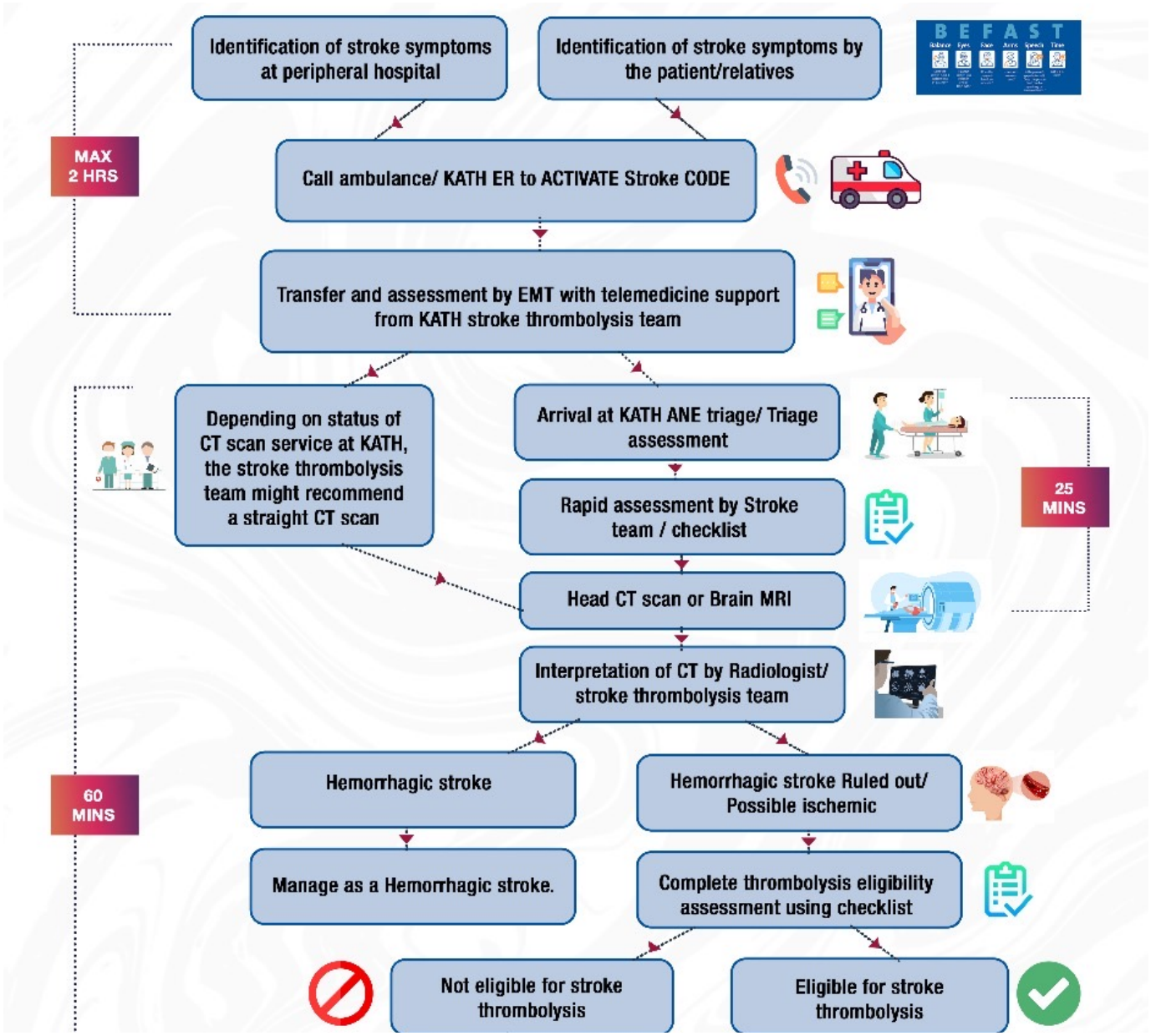
- **Stroke thrombolysis is recommended within 3-4.5 hours of symptom** onset (Ideally 3 hours because even severe strokes with NIHSS>25 benefit during this time window).
- For patients with wake-up strokes or within **4.5-6 hours** of last know well, MRI **must** be done to determine eligibility. [Call's logs may be helpful]

Timeline metrics

- Onset to door time 2 hours (KATH).
- Door to physician assessment – 10 mins
- Door to CT or MRI – 25 mins
- Door to CT interpretation – 45 mins
- Door to needle time – 60 minutes (1 hour).

- Stroke thrombolysis is a team effort
- Our aim is to beat time
- Not a one man show/ no superstars
- We all need to work together and in parallel
- Continuous evaluation and improvement is required




Identification of stroke symptoms at peripheral hospital
Identification of stroke symptoms by the patient/relatives
B E F A S T
MAX 2 HRS
Call ambulance/ KATH ER to ACTIVATE Stroke CODE
Transfer and assessment by EMT with telemedicine support from KATH stroke thrombolysis team
Depending on status of CT scan service at KATH, the stroke thrombolysis team might recommend a straight CT scan
Arrival at KATH ANE triage/ Triage assessment
Rapid assessment by Stroke team / checklist
Head CT scan or Brain MRI
25 MINS
Interpretation of CT by Radiologist/ stroke thrombolysis team
60 MINS
Hemorrhagic stroke
Hemorrhagic stroke Ruled out/ Possible ischemic
Manage as a Hemorrhagic stroke.
Complete thrombolysis eligibility assessment using checklist
Not eligible for stroke thrombolysis
Eligible for stroke thrombolysis

Summary of EMT tasks (During transfers)

- Prompt emergency dispatch
- Stroke screening (FAST)
- Pre-notification of Hospital
- Immediate transfer
- ABCs
- Blood sugar
- IV assess
- Rapid medical history (including list of medications)

Summary of triage nurse tasks [to be completed within 10 mins- parallel assessment is preferred]

- Prompt activation of stroke code (inform emergency physician of duty, medicine team on duty, radiology unit, neurology team)
- Stroke screening (FAST)
- Checking of blood sugar and BP
- IV assess
- Control of high BPs/ correction of hypoglycemia
- Connect cardiac monitor
- Prompt transfer to CT
- Rapid medical history (including list of medications)

Summary of Physician tasks [parallel assessment is preferred]

- Prompt activation of stroke code (Communicate with the rest of the team including emergency physician of duty, medicine team on duty, radiology unit, neurology team) if not aready done
- Coordination of all stroke code activities
- Stroke screening (FAST)
- NIHSS
- Control of high BPs/ correction of hypoglycemia
- Prompt transfer to CT
- Complete and handover the checklist (Important)

Neuroimaging

- In cases where pre-notification has been received, the radiology unit must be informed in advance to allow adequate preparation and allocation of space for the patient's arrival.
- In the absence of pre-notification, the radiology unit must still be notified immediately once an eligible patient is identified, and before the patient arrives at the CT or MRI suite, to enable timely preparation and facilitate rapid imaging.
- Also, note that patients transferred from peripheral hospitals may have a CT or MRI already. There should be no delay for additional imaging before thrombolysis is administered in eligible patients.
- For patients who require an MRI, CT scans are not required prior to an MRI. Also, time shouldn't be wasted to acquiring multiple MRI sequences other than FLAIR and DWI.

Neuroimaging

Eligibility:

- For otherwise eligible patients who are ready for neuroimaging within 3 hours of the onset of symptoms, an urgent non-contrast Head CT scan should be done to rule out hemorrhagic stroke, potential stroke mimics, and/ or confirm an ischemic stroke.
- For otherwise eligible patients who are ready for neuroimaging within 4.5-6 hours of last known well or with wake-up strokes, MRI with DWI should rather be performed.

THE 4 key PRIORITY ACTIONS

In our experience, prioritizing the following 4 key actions can help achieve the biggest effect in reducing your DTT time.

STEP 1

AMBULANCE PRE-NOTIFICATION

STEP 2

DIRECT TO CT

View ▸

STEP 3

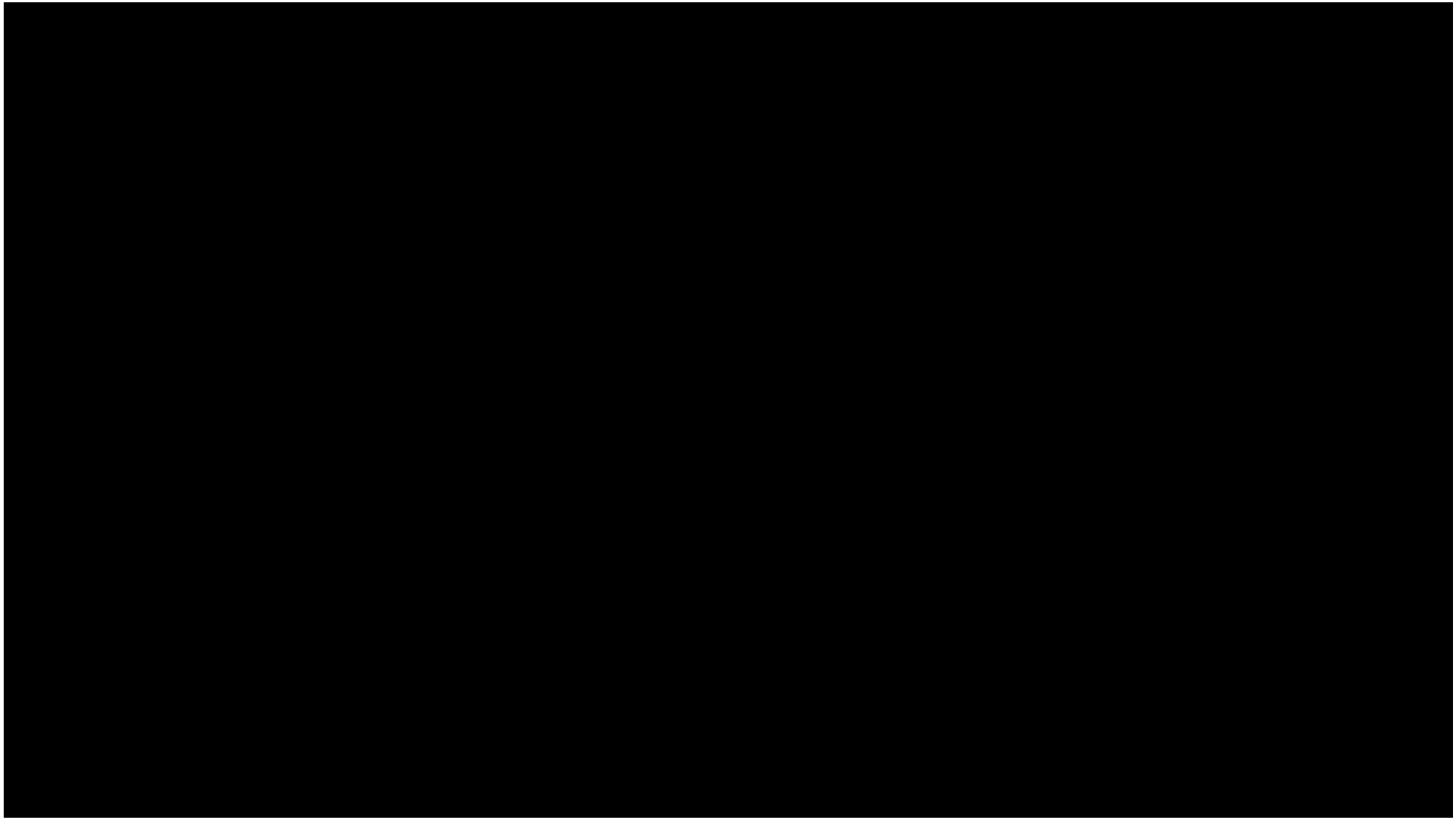
POC TESTING

View ▸

STEP 4

TREAT AT CT

View ▸




CHECKLIST

KOMFO ANOKYE TEACHING HOSPITAL STROKE THROMBOLYSIS CHECKLIST

Patient's Name: _____.

Age: _____.

GHIMS no.: _____

Hospital ID no.: _____

Date (day/month/year): _____

Triage unit Assessment (Triage nurse to complete)

Time of triage team assessment (GMT) _____

Time of stroke onset (GMT) _____

Duration of stroke symptoms _____

- ☐ Ambulance pre-notification received
- ☐ Clinical stroke diagnosed based on FAST positive symptoms of sudden onset
- ☐ Duration of symptoms confirmed to be less than 3-4.5 hours.
- ☐ **Activate code stroke**: Stroke team alerted. In case of pre-notification, Stroke team informed of patient's estimated arrival time
- ☐ Radiology informed to prepare CT scanner for stroke patient
- ☐ IV assess secured

Time Physician was alerted (GMT) _____

	Value	Threshold	Action Taken
Random Blood Glucose		<2.8mmol/l	
Blood Pressure		<185/110mm Hg	
Weight (kg)			

Name of triage Nurse assessing: _____

[NB: Must be indicated]

Physician assessment.

Time Physician was alerted (GMT) _____

Time of Physician assessment (GMT) _____

Time of stroke onset (GMT) _____

Duration of stroke symptoms _____

- ☐ Clinical stroke diagnosed based on FAST positive symptoms of sudden onset
- ☐ Duration of symptoms confirmed to be less than 3-4.5 hours.
- ☐ **Activate code stroke**: Rest of the team alerted.
- ☐ Radiology informed to prepare CT scanner for stroke patient

Name of assessing physician: _____.

[NB: Must be indicated]

Patient's History:

- ☐ Brief history of Neurological deficits
- ☐ Duration of symptoms/ Last known well.
- ☐ Premorbid state (prior disability) and Co-morbidities
- ☐ Other symptoms (vomiting, headaches, seizures)
- ☐ Medication history.

Absolute contraindications

- ☐ Previous intracranial haemorrhage
- ☐ Ischemic stroke or head trauma in the last three months
- ☐ Acute head trauma
- ☐ Gastrointestinal haemorrhage in the previous 21 days
- ☐ Spinal surgery in the last three months
- ☐ Intra-axial (intra-parenchymal) intracranial neoplasm
- ☐ Gastrointestinal malignancy
- ☐ Major surgery in the preceding 14 days (cardiac, thoracic, abdominal or orthopedics)
- ☐ Intracranial, and intra-spinal surgeries in the last three months
- ☐ Known bleeding diathesis.
- ☐ Patients on anticoagulants received within 48 hours except for prophylactic doses of Low Molecular Weight Heparin (LMWH) e.g., clexane.

Relative contraindications

- ☐ For patients with a seizure at the time of onset of acute stroke, evidence suggests that residual impairment is a postictal phenomenon.
- ☐ Coagulopathy: For patients with a history of warfarin use and INR > 1.7 and PT>15s and patients with a known bleeding diathesis.
- ☐ Arterial puncture: Patients who have had an arterial puncture of a non-compressible blood vessel in 7 days preceding stroke symptoms onset.
- ☐ Patients with systemic malignancy.
- ☐ For patients with history of hemorrhagic ophthalmologic conditions, it is reasonable to give thrombolysis however, the risk of visual loss should be weighed against the potential benefits of reduced stroke-related neurological deficits.

Focused physical examination.

	Value	Threshold	Recommended Action to be Taken
Random Blood Glucose		<2.8mmol/l	Correct hypoglycaemia if RBS less than 2.8mmo/L.
Blood Pressure		<185/110mmHg	Start BP control with Intravenous labetalol (10-20mg over 1-2mins) if BP greater than or equal to 185/110mmHg. This may be repeated once if BP is still greater than 185/110 mm Hg. However, if systolic BP is greater than 180-230 mm Hg or diastolic greater than 105 -120 mm Hg, then 10mg IV labetalol bolus should be followed by continuous infusion at 2-8mg per minute. If Labetalol is not available IV Hydralazine can be considered.
TOTAL NHISS SCORE			**NHISS score** Administer stroke scale items in the order listed. Record performance in each category after each subscale exam. Do not go back and change scores. Follow directions provided for each exam technique. Scores should reflect what the patient does, not what the clinician thinks the patient can do. The clinician should record answers while administering the exam and work quickly. Except where indicated, the patient should not be coached (i.e., repeated requests to patient to make a special effort). Refer to the protocol for the elaborate version of the scale.

Clinical:

Absolute contraindications

- ☐ Ischemic stroke in the last **three months**
- ☐ Symptoms suggestive of SAH
- ☐ Presentation consistent with infective endocarditis
- ☐ Aortic arch dissection
- ☐ Persistent BP elevation >185/110mmHg and unresponsive to treatment (If patient's Blood Pressure is successfully maintained at less than 185 for systolic and diastolic less than 110, thrombolysis can be administered)
- ☐ Active internal bleeding
- ☐ Acute bleeding diathesis
- ☐ Patients with mild non-disabling stroke and **NIHSS score 0-5**

Relative contraindications

- ☐ Severe strokes with **NIHSS>25** presenting within **3-4.5** hours **(NB:** otherwise, eligible patients with NIHSS score >25 who present earlier i.e., within **0-3 hours** may be considered for thrombolysis

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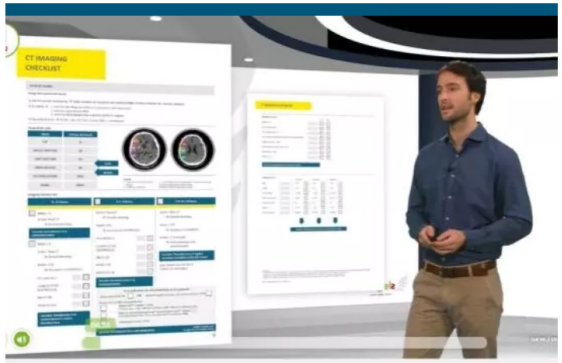

CT Imaging

CT IMAGING

Welcome to the "CT Imaging in Acute Stroke" course, designed to standardize the...

Training Score 0%

Progress 0%

VIEW COURSE

Time of neuroimaging (GMT) _____

Type of Neuroimaging

☐ CT. ☐MRI

Stroke type.

☐ Ischemic stroke ☐ Intracerebral hemorrhage ☐ Subarachnoid hemorrhage

Neuroimaging:

Absolute contraindications continued

- ☐ Any active intracranial haemorrhage including intracerebral hemorrhage, subarachnoid haemorrhage, epidural hemorrhage, or subdural hemorrhage.
- ☐ Hemorrhagic transformation of an ischemic stroke
- ☐ For patients who are otherwise eligible with a high burden of cerebral micro bleeds >10 demonstrated on MRI, **thrombolysis should not be administered.**
- ☐ For patients with CT brain imaging showing **extensive hypo attenuation**, thrombolysis is not recommended as this suggests irreversible brain injury.
- ☐ Patients presenting within **3-4.5 hours** however with MRI showing more than 1/3rd (Middle Cerebral Artery) MCA territory is ischemic; **thrombolysis should not be administered.**

Relative contraindications

- ☐ The patient is known to harbour unruptured and unsecured intracranial aneurysms >10mm.

Specific scenarios**(The following scenarios should not prevent the administration of thrombolysis in otherwise eligible patients)**

- Patients on antiplatelet therapy: Patients **can be given** thrombolysis therapy regardless of whether they are on **monotherapy or dual therapy.**
- Thrombolysis **can be administered** to patients with **sickle cell disease.**
- Thrombolysis **is beneficial** in patients with a **hyperdense MCA sign.**
- Dural puncture: Thrombolysis may be considered for patients who present with ischemic strokes, even in instances where they may have undergone a lumbar dural puncture in the preceding 7 days.
- Extra-axial intracranial neoplasms: It is reasonable to give thrombolysis in patients with extra-axial intracranial neoplasms.
- Acute myocardial infarction: For patients with concomitant acute MI, treatment with thrombolytic agents should be at a dose appropriate for the ischemic stroke, followed by percutaneous coronary angioplasty and stenting if indicated.
- Procedural stroke: Thrombolysis can be administered if the stroke is a complication of cardiac or cerebral angiographic procedures.
- Patients with illicit drug abuse can be given thrombolysis unless there is any other contraindication.

Grey areas

(Consultation with a neurologist is required whenever such scenarios are encountered)

- ☐ Recent major trauma without head injury: In acute ischemic stroke patients with major trauma within 14 days, not involving the head, thrombolysis may be carefully considered with the risk of injuries related to trauma weighed against the severity and potential disability from the ischemic stroke.
- ☐ Recent major surgery: Thrombolysis may be considered in selected patients who have undergone major surgery in the preceding 14 days if the potential risk of surgical site hemorrhage is less compared to the anticipated benefits.
- ☐ History of Gastrointestinal bleeding (remote >21 days ago), genitourinary bleeding.
- ☐ Menstruation: Thrombolysis is indicated if a woman in her menses presents with an acute ischemic stroke and has no history of menorrhagia. However, women should be warned that thrombolysis could increase their degree of menstrual flow. When there is a history of active or recent vaginal bleeding with significant anaemia and the risk of bleeding outweighs the benefits, an emergency gynaecological consult should be made before the decision to thrombolyze is finalized.

- ☐ Pregnancy: Thrombolysis can be given in pregnancy or early postpartum less than 14 days after delivery when the anticipated benefits of treating the moderate or severe stroke outweigh the anticipated risks of uterine bleeding
- ☐ Concomitant use of **tirofiban** and **eptifibatide:** the efficacy of concomitant use of these agents with thrombolysis is not well established.
- ☐ Recent MI (it is reasonable to administer thrombolysis in patients with recent N-STEMI or STEMI involving right inferior and left anterior myocardium.
- ☐ Acute pericarditis: otherwise, eligible patients, treatment with thrombolytics is reasonable however urgent discussion with a cardiologist is required.

Is this patient eligible for IV thrombolytic therapy?

☐ Yes ☐ No

Consent Procedure

Consent has been obtained from the patient or his/her Legally authorized representative prior to administration.

☐ Yes ☐ No

KOMFO ANOKYE TEACHING HOSPITAL CONSENT FORM FOR STROKE THROMBOLYSIS

Patient Information:
Name of Patient: _____
LHIMS Number: _____
Date and Time: _____

Statement of the Doctor Obtaining Consent for Stroke Thrombolysis:
I, _____, have thoroughly explained and provided comprehensive information about thrombolysis for acute non-bleeding stroke, encompassing the procedures, associated risks, and potential benefits to _____.
This information is intended to help the, and/or their relatives to make an informed decision regarding stroke thrombolysis.

Statement of the Patient or Relative Giving Consent for Stroke Thrombolysis:
I, _____, hereby authorize and consent to receive thrombolysis treatment for acute non-bleeding stroke.
I, and/or my family member/s, understand that I have experienced a stroke, and thrombolysis is one of the available treatment options for my condition.
Benefits: I understand that the treatment may improve my stroke symptoms, but this is not guaranteed.

Risks: I understand that the procedure may entail the following risks:

- Bleeding in the brain, may result in the worsening of stroke symptoms, permanent neurologic injury (such as paralysis or coma), or even death.
- Bleeding in other parts of the body.
- The need for blood transfusions to replace blood or clotting factors.
- Allergic reactions to medications.
- Other unexpected complications.

Thrombolysis procedure

Dosage of Tenecteplase for stroke thrombolysis: Tenecteplase should be given at a dose of 0.25mg/kg body weight. The maximum dose for stroke thrombolysis is 25mg. Patients weighing above 100kg should receive a dose of 25mg.

The patient's weight or estimated weight is_____.

The dose of Tenecteplase to be given in this patient is _____.

Reconstitution of Tenecteplase

- ☐ Tenecteplase has been reconstituted with the water for injection to a concentration of 5mg/ml. (For instance, the 40mg and 50mg Tenecteplase should be reconstituted with 8ml and 10ml diluent respectively).
- ☐ The diluent has been gently added to the powder to avoid foaming. If slight foaming occurs, leave the solution undisturbed for some minutes to allow the dissipation of large bubbles and gently swirl to ensure complete dissolution. (Do not shake).
- ☐ The solution has assumed a colourless to pale yellow coloration after reconstitution.

Administration of Tenecteplase

NB: An anaphylaxis tray should be available prior to the commencement of thrombolytic therapy. This should comprise an Intubation set, IV methylprednisolone 125 mg, IV diphenhydramine 50 mg, IV ranitidine 50 mg or famotidine 20 mg IV, and 0.3mls of Sc epinephrine (0.1%).

For Alteplase (rt-PA)

There is also an option to use Alteplase. KATH 24-hour pharmacy now has subsidised alteplase available.

Dosage of Alteplase for stroke thrombolysis

Alteplase should be given at a dose of 0.9mg/kg body weight. **The maximum dose for** stroke thrombolysis is **90mg**. Patients weighing above 100kg should receive a dose of 90mg.

Reconstitution of Alteplase

- Alteplase is supplied as a **lyophilised powder** (commonly 50 mg or 100 mg vials) with accompanying **sterile water for injection**.
- Reconstitute Alteplase to a **final concentration of 1 mg/mL** using the diluent provided.
    - Example: Reconstitute a 50 mg vial with 50 mL of sterile water for injection.

Post Thrombolysis Monitoring and management: First 12-24 hours.

After the administration of Tenecteplase, the patient should be monitored at the RED ward for 12-24 hours or Main ICU (depending on the patient's condition).

- The team should look out for signs of neurological improvement or deterioration.
- The patient should be on a cardiac monitor.
- Administration of IV Infusions should be individualized. If there are no contraindications, IV Normal Saline infusing should be set up at 50 mL/hr for the first 6 hours post-treatment.
- Investigations: CBC, Electrolyte panel, PT(INR), random glucose, and 12 lead EKG should be ordered.
- **Vitals:** BP, Pulse, and SPO_2 should be monitored every 15 minutes for the first 2 hours and then every 30 minutes till 6 hours post-treatment, Then every 1 hour for 16 hours and then every 4 hours till 48 hours.

- The frequency of monitoring should be reassessed afterward.
- **BP control:** the blood pressure should be maintained below 180/105 mmHg.
- **National Institute of Health Stroke Scale (NIHSS):** NIHSS should be completed prior to or immediately following Tenecteplase bolus and then repeated at 30min, 60 min, 3h, 6h, 12h, 24h, 48h and 72h thereafter and with any change in neurological condition.
- Monitor for signs of clinical deterioration including an increase in NIHSS greater than 4 points sign (which signifies neurological worsening) or sudden severe headache with blood

- Record all or any potential adverse effects.
- Avoid Intramuscular injections and unnecessary invasive procedures to reduce the risk of bleeding.
- Limit arterial punctures to an upper extremity vessel that is accessible to manual compression; apply pressure dressing to puncture sites.
- Keep patient NPO and hold oral meds pending swallow screen.
- Swallow screen: Patients who are unable to swallow or who have GCS <11/15 should receive an NG tube.
- Carefully and gently insert a Foley catheter only if absolutely required.
- Intermittent Pneumatic compression (IPC) device should be given within the first 24 hours if available.

Management of Symptomatic Intracranial Bleeding within 24 Hours After IV thrombolysis

- The thrombolytic agent should be turned off immediately if it is still running. (NB: This applies to other agents that are given as infusion such as alteplase but not tenecteplase, which is given as a bolus).
- Order CBC, PT (INR), aPTT, fibrinogen (if available), blood grouping and crossmatching.
- Order an **urgent non-contrast Head CT**.
- Start Factor VIII-containing cryoprecipitate: Infuse 10 U over 10-30 min (onset in 1 h, peaks in 12 h); augment dose for fibrinogen <150 mg/dL.
- Start Tranexamic acid 1000 mg IV (administered over 10 min) or ε-aminocaproic acid 4–5 g over 1 h, then 1 g IV until bleeding is controlled (peak onset in 3 h). It may be beneficial for all patients, especially if blood products are contraindicated, denied, or unavailable in a timely manner.
- Neurosurgery and hematology consults.
- Supportive therapy includes BP, ICP, CPP, MAP, temperature, and glucose control.

Management of thrombolysis Associated Orolingual Angioedema for AIS

- Maintain the airway.
- No endotracheal intubation may be needed if edema is localized to the anterior tongue and lips.
- The rapid advancement of edema in the larynx, palate, floor of mouth, or oropharynx within 30 minutes increases the likelihood of intubation.
- Fiberoptic intubation is best awake.
- If nasal-tracheal intubation is needed, it may increase the risk of epistaxis after thrombolysis.
- Cricothyroidotomy is uncommon and troublesome following thrombolysis.
- Hold ACE inhibitors and stop IV Tenecteplase. Give 125 mg IV methylprednisolone or 200mg IV hydrocortisone
- Give either IV Promethazine 50 mg or IV ranitidine 50 mg.
- If angioedema worsens, give epinephrine (0.1%) 0.3 mL subcutaneously or nebulized.

Monitoring and management Poststroke thrombolysis: next 24 to 48 hours.

After the first 24 hours post thrombolysis, the patient can be transferred to the stroke unit.

- ☐ **Vitals:** BP, Pulse, SPO_2 is being monitored every 4 hours till 48 hours.
- ☐ **BP control:** the blood pressure has been maintained below 180/105 mmHg.
- ☐ **National Institute of Health Stroke Scale (NIHSS):** NIHSS is being assessed daily for any change in neurological condition.
- ☐ **A Non-contrast CT scan or MRI** has been **repeated** after **24 hours** to assess for hemorrhagic conversion.
- ☐ There is no evidence of hemorrhagic conversion, hence IV clexane for VTE prophylaxis can be started after 24 hours of thrombolysis.
- ☐ Aspirin and atorvastatin have been started for secondary prevention of stroke after 24 hours of thrombolysis.

Be sure to make a clinical diagnosis of stroke before you trigger the code (we don't want to thrombolyse stroke minics)

Don't abuse the priority line

Don't abuse the stroke code for old stroke cases

- Stroke thrombolysis can fail
- Stroke thrombolysis should be ideally followed by assessment for thrombectomy
- Stroke thrombolysis should be followed by stroke unit care including general measures, secondary prevention and rehabilitation (early recurrence may occur is risk isnt mitigated)
- Stroke thrombolysis is a team effort and not a one man show (Quote from Prof Sarfo)
- Don’t wait till you or your loved one falls victim


THANK
YOU
FOR
YOUR
ATTENTION