Acute Ischemic Stroke

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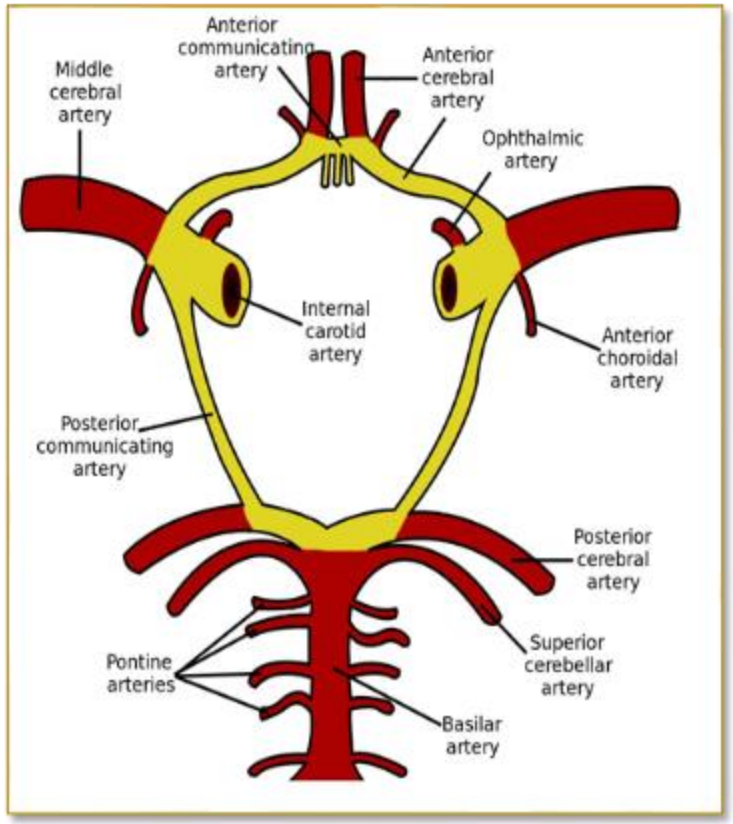
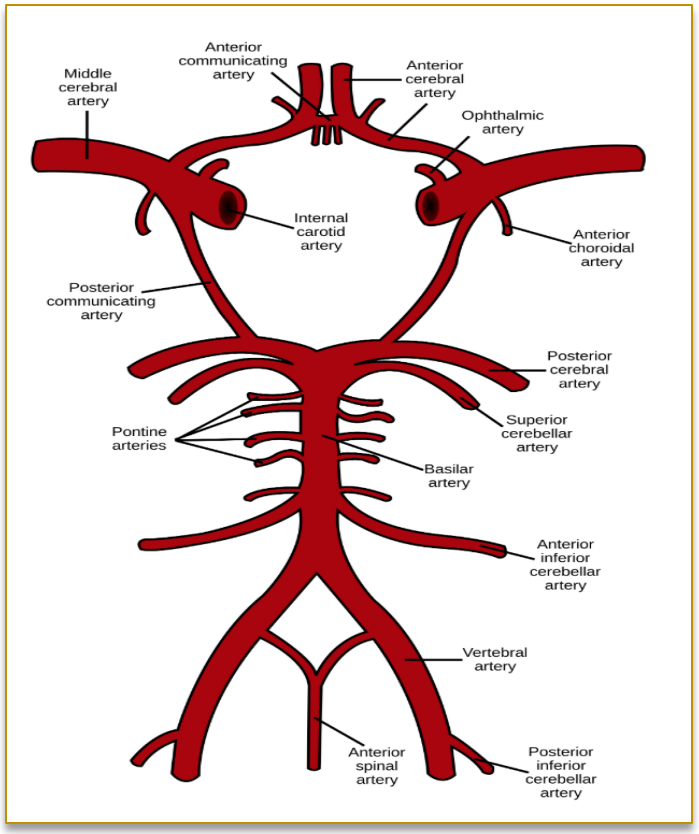
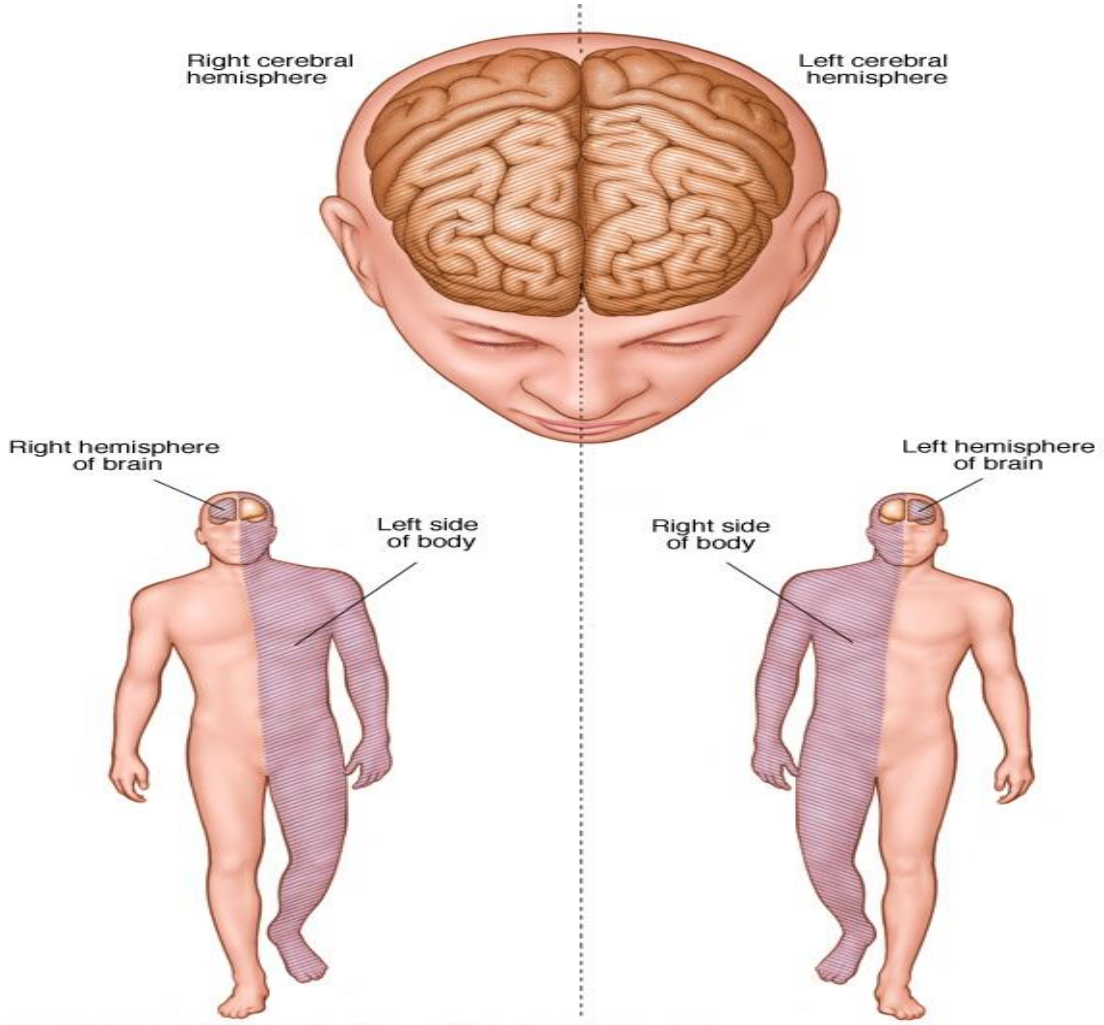
Blood supply of the brain

- Anterior circulation
  - Middle cerebral artery
  - Anterior cerebral artery
- Posterior circulation
  - Posterior cerebral artery
  - Basilar artery
  - Vertebral arteries
- Circle of Willis





Cerebral hemisphere control opposite body



Stroke definition

- A sudden neurological deficit attributed to an acute focal injury secondary to vascular cause of the central nervous system CNS
  - Brain
  - Spinal cord
  - Retina

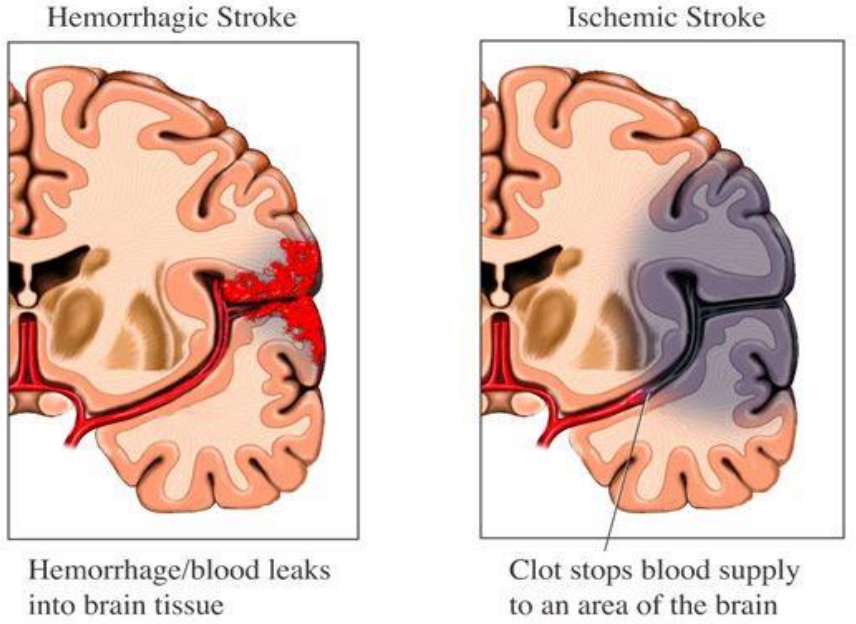
- 4th leading cause of death UK and 3rd in Scotland
  - 35,000 deaths/y
  - 3rd leading cause of death in USA.

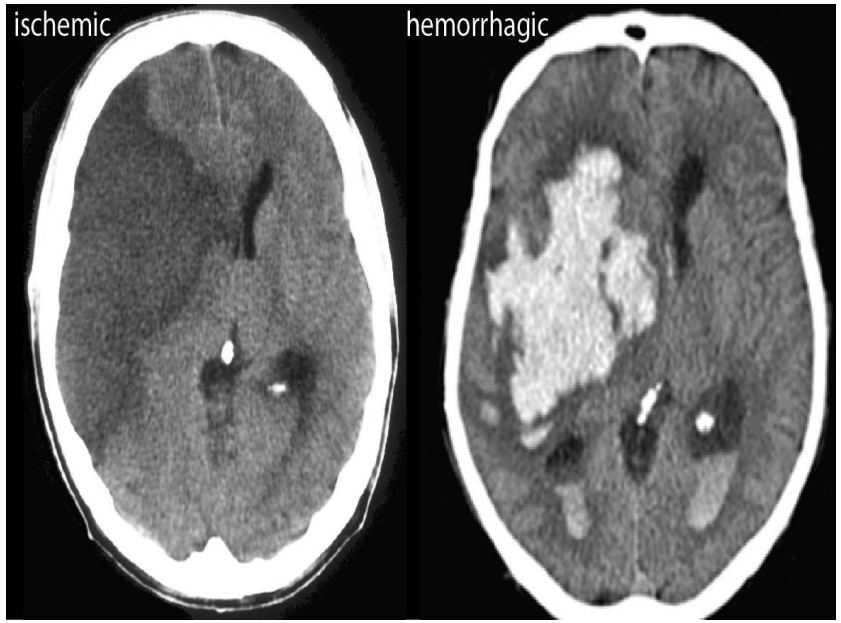
- Stroke
  - Is a medical emergency
  - Urgent treatment.

Types of stroke

1. Acute ischemic stroke
   - 85%
   - Older patients

2. Acute haemorrhagic stroke
   - Intracerebral haemorrhage
   - SAH
     - 15%
     - Younger patients





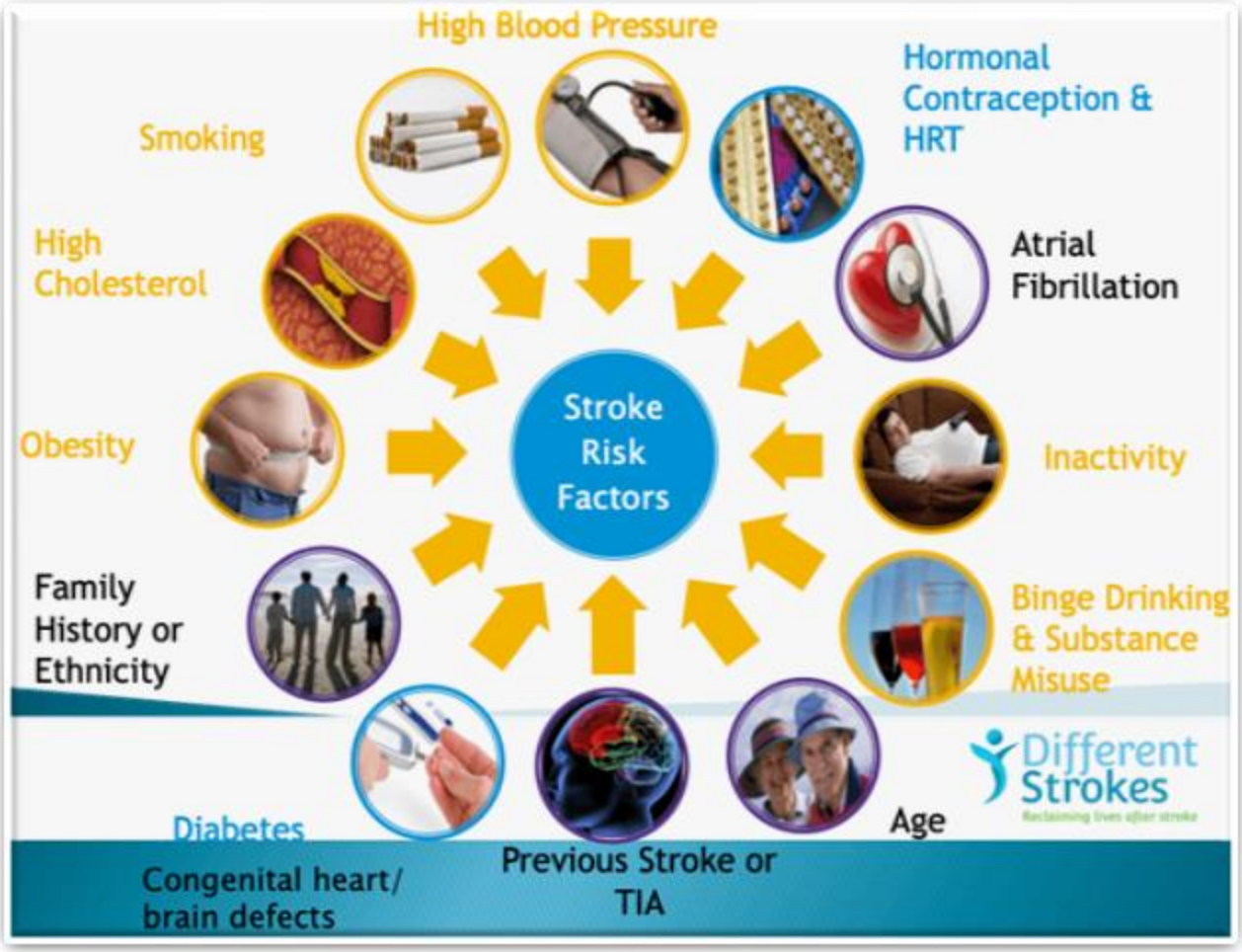
Transient ischemic attack TIA

- The risk of stroke is 1.5 - 3.5% in the first 48 hours after TIA
- 40% in 90 days.

TIA is a medical emergency

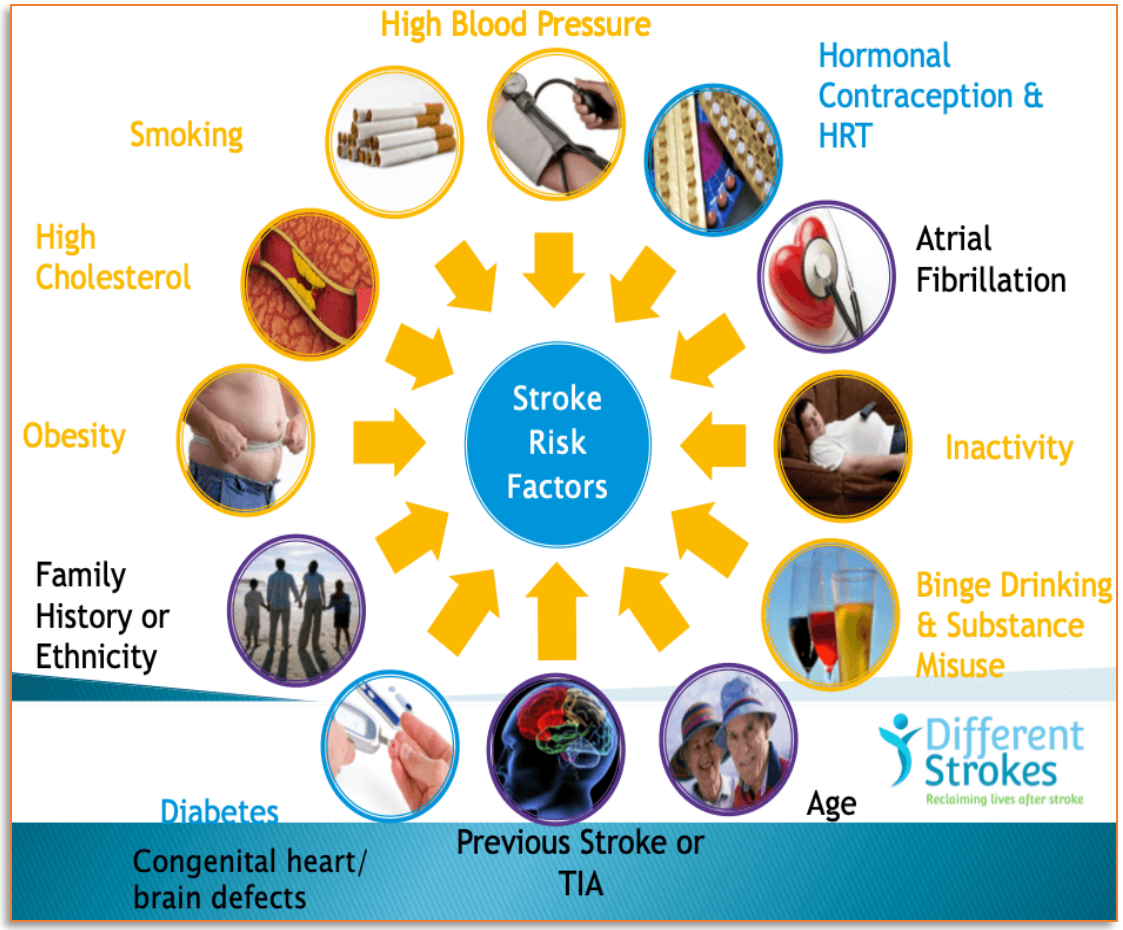
Risk factors

- Major
  - Aging > 55y
  - Hypertension
  - Ischemic heart disease
  - Atrial Fibrillation
  - Smoking
  - Diabetes



Risk factors

- H/O Stroke and TIAs
- Excess alcohol
- Dyslipidaemia
- Drugs cocaine and amphetamines
- Anticoagulants and antiplatelets
- Obesity
- Family history



Stroke recognition (outside the hospital)

CEDARS-SINAI

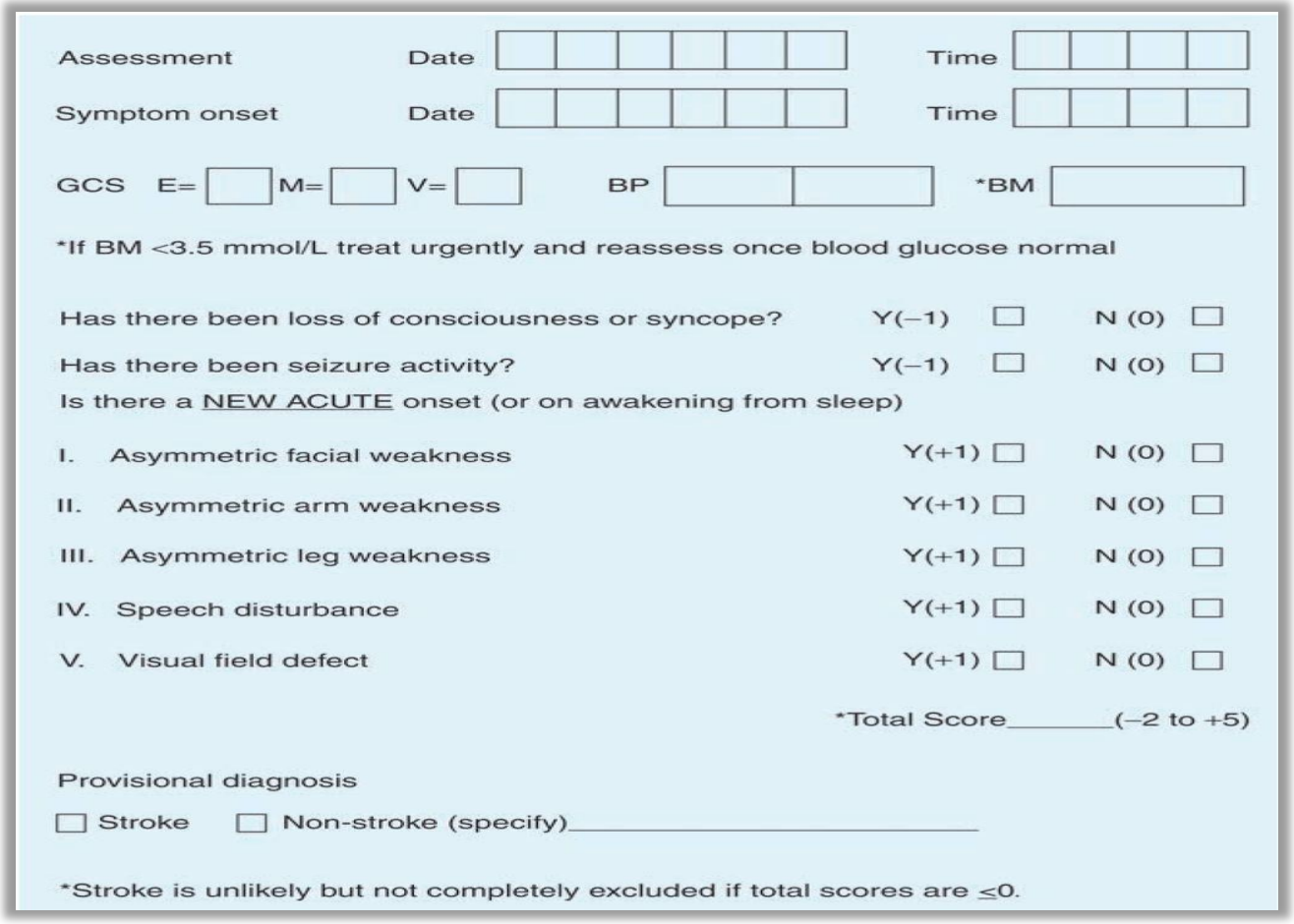
Spot the signs of a stroke **F.A.S.T.**

During a stroke, every minute counts. You could save a life by recognizing these signs of a stroke:

FACE	Ask the person to smile. Is one side of the face drooping?
ARMS	Ask the person to raise their arms. Is one arm weak?
SPEECH	Ask the person to speak. Is their speech slurred?
TIME	Call 911 right away at the first sign of a stroke.

ROSIER

- ***R***ecognition ***O***f ***S***troke ***I***n ***E***mergency ***R***oom
- Score -2 to +5
- Score > 0 stroke is likely
- Score ≤ 0 stroke is unlikely



Assessment Date Time

Symptom onset Date Time

GCS E= M= V= BP *BM

*If BM <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

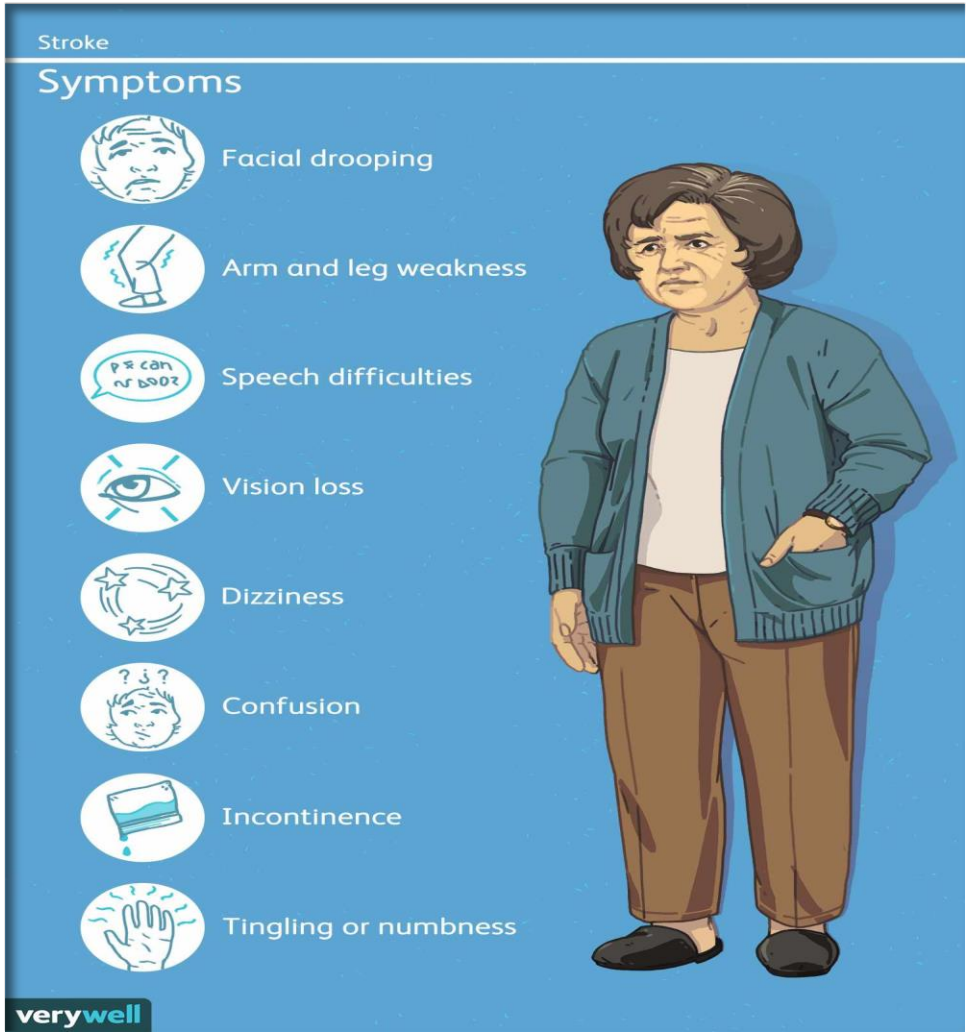
☐ Stroke ☐ Non-stroke (specify)_____

*Stroke is unlikely but not completely excluded if total scores are ≤0.

Symptoms

- Facial weakness
- Dysarthria
- Dysphasia
- Hemiplegia and hemiparesis
- Hemianesthesia

- Incoordination and unsteadiness
- Dysphagia



Rapid evaluation of stroke patients

- Every minute of ischemia passes 1.9 million neurons die

Time is brain

Rapid evaluation (10 minutes)

- Patients assessment (10 min)
  - History (onset time)
  - Clinical examination (NIHSS)
- Blood investigation and ECG
- CT brain scan (*images should be available within 25min*)

- *Exclude hypoglycaemia*
  - *in people with sudden onset of neurological symptoms as the cause of these symptoms*

NIHSS

National Institute of Health Stroke Scale
maximum points 42

1a—Level of consciousness	0 = Alert; keenly responsive 1 = Not alert, but arousable by minor stimulation 2 = Not alert; requires repeated stimulation 3 = Unresponsive or responds only with reflex
1b—Level of consciousness questions: What is your age? What is the month?	0 = Answers two questions correctly 1 = Answers one question correctly 2 = Answers neither questions correctly
1c—Level of consciousness commands: Open and close your eyes Grip and release your hand	0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly
2—Best gaze	0 = Normal 1 = Partial gaze palsy 2 = Forced deviation
3—Visual	0 = No visual lost 1 = Partial hemianopia 2 = Complete hemianopia 3 = Bilateral hemianopia
4—Facial palsy	0 = Normal symmetric movements 1 = Minor paralysis 2 = Partial paralysis 3 = Complete paralysis of one or both sides
5—Motor arm Left arm Right arm	0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
6—Motor leg Left leg Right leg	0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
7—Limb ataxia	0 = Absent 1 = Present in one limb 2 = Present in two limbs
8—Sensory	0 = Normal; no sensory loss 1 = Mild-to-moderate sensory loss 2 = Severe-to-total sensory loss
9—Best language	0 = No aphasia; normal 1 = Mild-to-moderate aphasia 2 = Severe aphasia 3 = Mute; global aphasia
10—Dysarthria	0 = Normal 1 = Mild-to-moderate dysarthria 2 = Severe dysarthria
11—Extinction and inattention	0 = No abnormality 1 = Visual, tactile, auditory, spatial, or personal inattention 2 = Profound hemi-inattention or extinction
Score = 0–42	

Stroke mimics

- Epilepsy (post ictal status)
- Sepsis
- Hypoglycaemia and hyperglycaemia
- Functional
- Brain tumours
- Brain infection (abscess)
- Migraine (hemiplegic migraine)
- SDH
- Multiple sclerosis.

Brain imaging

- CT brain
  - Widely available
  - Fast
  - To exclude intracerebral bleed and other causes of stroke

- MRI
  - Limited availability
    - Takes longer time.

Thrombolysis with alteplase

- NINDS (National institute of neurological disorders and stroke trial) 1995
- ECASS (European cooperative acute stroke study trial)

- Thrombolysis within an hour after patient arrival to hospital

Aim for ≤ 60 min

Eligibility for thrombolysis

- Ischemic stroke
  - Neurological deficit Symptoms

- Start of symptoms
  - <4.5 hours
    - Risk of haemorrhagic transformation ↑↑ after 4.5 h
- Age > 18y

Exclusion criteria

- CT scan
  - Haemorrhagic stroke
  - Extensive damage to the brain with obvious hypodensity (> 6 hours)
- Persistent ↑BP
  - >185/110 not responding to antihypertensives
- Anticoagulation use
  - INR >1.7, APTT >40 seconds
  - Therapeutic LMWH use within 24h (not prophylactic LMWH)
  - Use of DOACs within 48h.
  - Platelets <100.000/m^3

Exclusion criteria

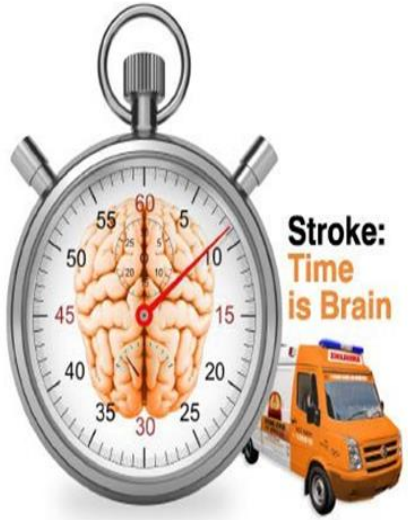
- Stroke or head trauma with 3 months
- H/O haemorrhagic stroke
- Brain tumours
- GIT bleed with 3/52
- GIT malignancy
- Intracranial or intraspinal surgery within 3/12
- Blood glucose < 2.7mmol/L

Exclusion criteria

- Active internal bleed
- ? Endocarditis
- Suspected Aortic dissection
- Established infarction >1/3 of cerebral hemisphere

Patient Consent

- Explain the benefits and risk of thrombolytic therapy with the patient/ NOK



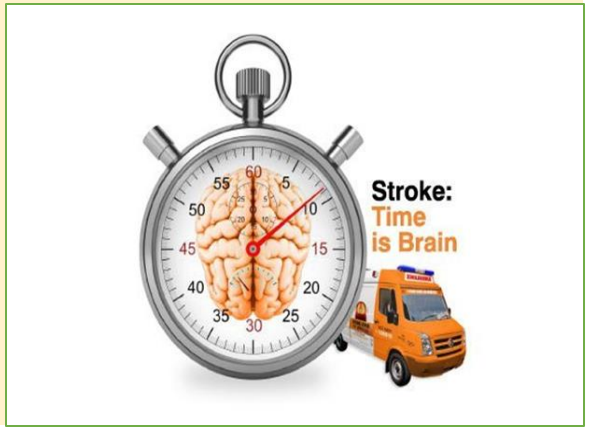
- Consent is not required
  - Eligible patient with disabling symptoms.
  - No NOK available.

- Start thrombolytic therapy for patients with thrombolytic window (4.5 h)

Thrombolytic therapy

- Alteplase (rt-PA)
  - Within 4.5 h from symptoms
  - Do not give thrombolytic therapy after 4.5 from symptoms onset
  - Dose
    - 0.9mg/kg (max 90mg)
      - 10% given as a iv bolus
      - 90% iv infusion over 60moin

- 80 kg patient
- Dose is
  - 0.9x80=72mg
  - 7.2mg iv bolus over 1 min
  - 64.8mg iv infusion over 60min



Neurological observation

- Vital signs and neurologic status
  - Every 15 minutes for two hours,
  - then every 30 minutes for six hours,
  - then every 60 minutes until 24 hours from the start of thrombolysis.
- Blood pressure
  - Maintain ≤ 180/105 mmHg during the first 24 hours
- Anticoagulant and antithrombotic agents
  - should not be administered for at least 24 hours and after post thrombolytic CT brain scan
- Intra-arterial catheters, indwelling bladder catheters, and nasogastric tubes should be avoided for at least 24 hours if the patient can be safely managed without them.

Complication of Thrombolytic therapy

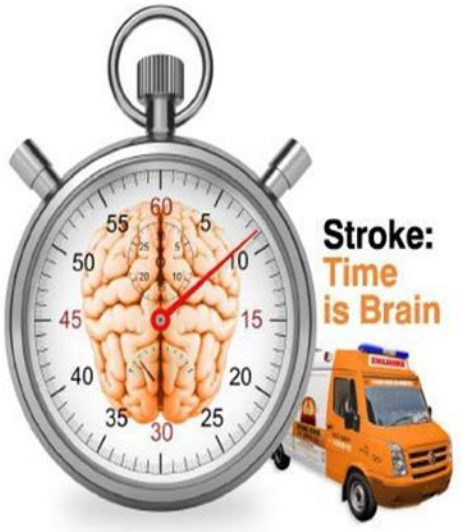
- Symptomatic intracerebral haemorrhage should be suspected
  - Sudden neurologic deterioration
  - Decline in level of consciousness
  - New headache
  - Nausea and vomiting
  - Sudden rise in blood pressure

Mechanical thrombectomy (MT)

- Within 24 hours of stroke symptoms.
- Persistent disabling neurological symptoms.
- CT brain scan
  - No haemorrhage in CT scan
  - Small stroke, ASPECT score ≥ 6
  - Angiography ➔ large artery occlusion, ICA/ MCA/ Basilar arteries

Mechanical thrombectomy (MT)

- NIHSS score > 5 (NICE guidelines)
- Baseline mRS 0 - 2
- Age 18-90y
- Stroke centre with MT experience



Nutrition and hydration

- Swallowing screen with 4h
- Dietary advice
- NGT feed within 24h

- Assess for malnutrition

Aspirin treatment

- IST (International stroke trial)
- CAST (Chinese acute stroke trial)
  - Benefit of aspirin

- Patient not suitable for thrombolysis
  - Aspirin 300mg for 2 weeks PO/PR
  - Clopidogrel 75mg od or aspirin 75 mg od

  - PPI

Anticoagulation

- All ischemic stroke with atrial fibrillation should be offered anticoagulation if no contraindications
  - Aspirin for 2-14 days
  - DOACs
  - Warfarin

Statin

- All patients should be offered statin. aim for LDL-c < 1.4mmol/l

- Always give high intensity statin
  - Atorvastatin 80mg
  - Rosuvastatin 20mg

Blood pressure management

- 185/110

DVT prophylaxis

- Intermittent pneumonic pressure device
  - Flowtron

- LMWH

Managing risk factors

- Blood sugar control
- BP control
- Obesity
- Alcohol intake
- Dyslipidaemia
- Smoking cessation
- Discourage drugs abuse

Stroke Rehabilitation

- Physiotherapy
- Occupational therapy

Stroke prevent

- Secondary prevention medications
- Eating healthy diet (low fat, salt and sugar)
- Regular exercise (60 min daily)
- Optimum weight
- Reduce alcohol intake (< 14 units a week)
- Stopping smoking
- Carotid Endarterectomy.

Thank you

Complications

- Malignant MCA syndrome
- Pneumonia
- UTI
- Seizures
- Depression
- Pressure sores
- DVT/PE

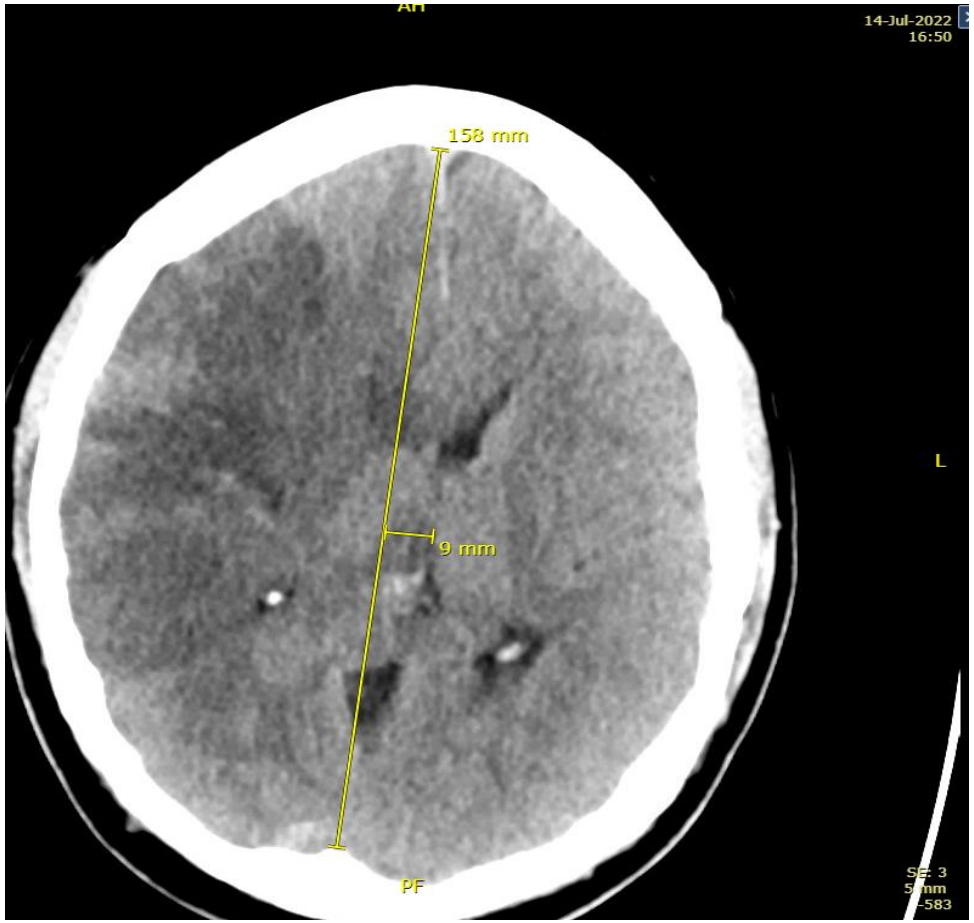
Malignant MCA syndrome

- Malignant MCA infarction' is the term used to describe rapid neurological deterioration due to the effects of space occupying cerebral oedema following middle cerebral artery (MCA) territory stroke.
  - Develop from1 to several days after stroke
    - Rapid deterioration
    - Headache
    - Vomiting
  - High intracranial pressure
  - Transtentorial shift
  - Death 80%

- High intracranial pressure
- Trans-tentorial herniation and brain stem compression
- Prognosis is poor
  - Death 80%

- Treatment
  - Surgical decompression
    - craniotomy

Malignant MCA syndrome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Thank you

Acute hemorrhagic stroke (spontaneous ICH)

- Causes
  - Hypertension (deep haemorrhage)
  - Cerebral amyloid angiopathy (lobar haemorrhage)

  - AV malformation
  - Cerebral venous thrombosis
  - Brain tumours
  - Haemorrhagic infarction
  - Sepsis
  - Drugs
  -

Haemorrhagic stroke

- Basal ganglia is the most commonly affected 80%
  - Putamen and globus pallidus
  - Internal and external capsule
  - Thalamus
- Lobar haemorrhage 15%
- Cerebellum 7%

Risk factors

- Hypertension
- Old age
- Cerebral amyloid angiopathy
- Anticoagulation (warfarin, DOACs and heparin)
  - 3-4 times higher than patients not on anticoagulants
  - Worse with warfarin than DOACs
- Antiplatelets small risk

Risk factors

- Diabetes
- Smoking
- Obesity and sedentation
- Small vessel disease
- Alcohol
- COAD
- Stimulating drugs e.g. cocaine
- Infections HIV, endocarditis

Clinical presentation

- Headache
- Nausea and vomiting
- Progressive symptoms
- decrease consciousness large haemorrhage
- Coma (very bad)

Clinical signs

- Depends on the location of haemorrhage
    - Hemiplegia
    - Hemisensory loss
    - Homonymous hemianopia
    - UpGaze Palsy
    - Stupor and coma if large
    - Dysarthria
    - Unsteadiness and ataxia
    - Seizures
    - Deep coma

Management of IC haemorrhage

- ABC assessment
- Assess if the patient for CPR and escalation of therapy, if so
- Admit to ITU or stroke unit.
- Assess airway, breathing, circulation, and disability to initiate supportive care

Laboratory

- Blood for
  - FBC (platelets)
  - U&Es, LFT, glucose
  - INR, PT and APTT
  - Toxicology e.g. cocaine (young patients)
  - Pregnancy test in a women of childbearing age
  - Cardiac monitor
    - High risk of cardiac arrhythmias e.g. AF, VT and VF

- MRI
- CTA/ MRA
  - To determine the aetiology e.g. aneurysms and AVM
- CTV/MRV

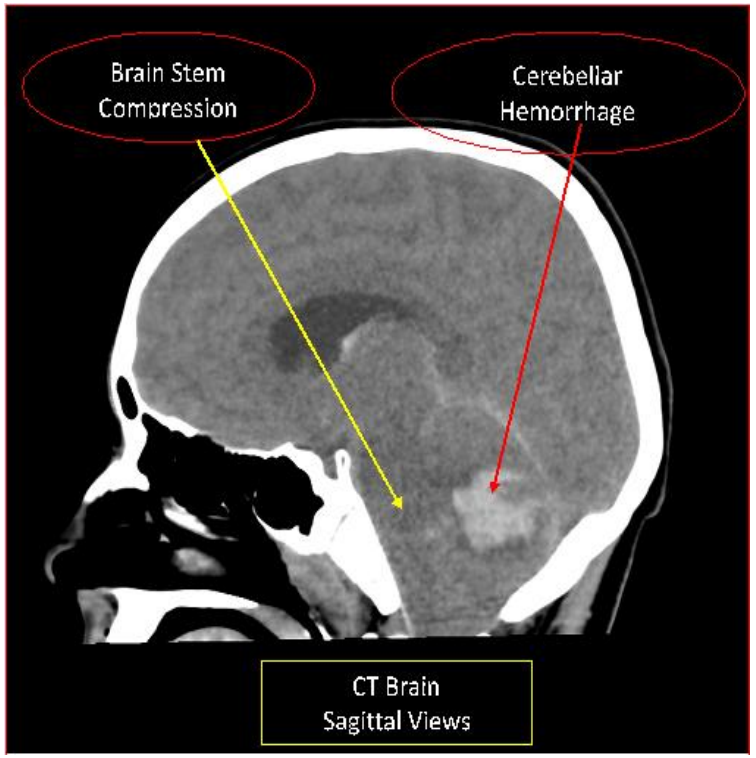
- MRI in 4-6 weeks

- Neuro-observation hourly
  - Neurological deterioration
  - Signs of increased intracranial pressure
    - Headache
    - Vomiting
    - Decrease GCS
    - Confusion
    - More neurological deficit

Management

- Intubation
  - if patient is unable to protect their airways
  - Rapid deterioration if GCS ≤ 8

- Obtain neurosurgical opinion
  - Cerebellar bleed > 3cm in diameter or causing brain stem compression
  - IVH with hydrocephalus



Neurosurgical referral

- All patients with ICH should be referred to neurosurgeon if
  - Modified Rankin Scale score ≤ 3
- AND **any** of the following:
  - GCS ≤12
  - Posterior fossa ICH (brainstem and/or cerebellum)
    - Causing brain stem compression
  - Obstruction of the 3rd and/or 4th ventricle(s)
  - Haematoma volume > 30 ml (measured by ABC/2 method* or on Brainomix Platform)
  - Hydrocephalus.

Indications for surgery in ICH

- Cerebellar haemorrhage.
- Brainstem compression.
- Hydrocephalus due to ventricular obstruction.
- Intraventricular haemorrhage.
- Supratentorial (hemispheric) haemorrhage associated
  - Acute neurological deterioration.
  - Life-threatening brain compression.
  - Hydrocephalus.

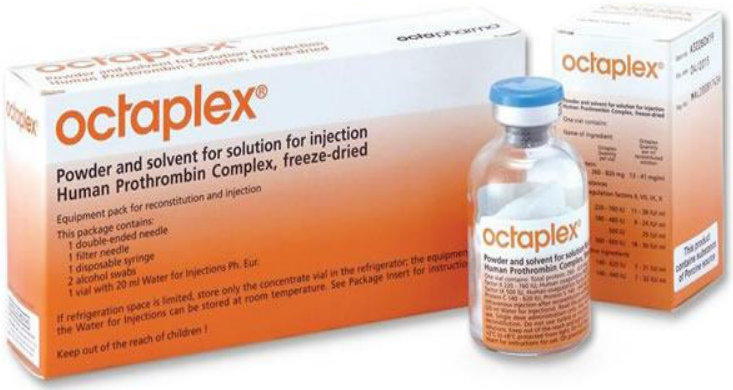
Patients who are not for surgery

- Elevate head of the bed 30°
- Mild sedation
- Paracetamol of temp. > 38°
- Maintain Na >135 mmol/l
- N. saline fluid if needed
  - Avoid in the first 24 hour
  - Never give glucose of hypotonic solutions

- Repeat CT brain if deteriorate (GCS ≤ 2)

- Reverse anticoagulation
  - Discontinue antiplatelets and anticoagulants

- Warfarin
  - 4F-PCC
    - Octaplex Vitamin. K dependant coagulation factors II, VII, IX and X (Octapharma)
    - Beriplex (CSL Behring)
    -
  - IV vitamin K 10mg



DOACs

- Dabigatrin (Pradaxa) prothrombin inhibitor
  - Idarucizumab (Praxbind) 5g from Boehringer Ingelheim Limited
    - Give 5g IV

  - Activated 4F-PCC
    - Octaplex
      - 50U/kg
    - Beriplex

Oral factor Xa inhibitors

- Apixaban, Edoxaban and Rivaroxaban
  - Andexanet alfa (AndexXa) Portola Pharmaceuticals.
  - 4F-PCC
    - Octaplex (Octapharma)
      - D/W hematology
      - 50U/kg
    - Beriplex (CSL Behring)
    -

- Heparin
  - Prothamine sulphate
- LMWH e.g. dalteparin
  - Prothamine sulphate
  - Andexanet alpha
- Thrombocytopenia
  - Platelets transfusion

Blood pressure management

- Systolic BP 150 - 220 mmHg,
  - Lower systolic BP to a target of 140 mmHg within an hour of presentation

- Systolic BP >220 mmHg,
  - Lower Systolic BP to 140-160 mmHg over hours (6 hours).

- Several agents can be used
  - IV labetolol 10mg IV bolus then infusion
  - IV nitares
  - ACEi and CCB

- Internal capsule
  - Mild dysarthria
  - Contralateral hemiparesis
  - Sensory deficit

- Caudate nucleus
  - Acute-onset confusion
  - Personality changes
  - Memory impairment
  - Transient contralateral weakness or numbness

- Cerebellar hemorrhage
  - inability to walk due to imbalance
  - Vomiting
  - Occipital headache.
  - Pain in the neck or shoulder
  - Neck stiffness
  - Gaze palsy
  - Facial weakness
  - Notably, there is often no hemiparesis
  - Stuporous due to obstructive hydrocephalus or brainstem compression.

- Thalamic haemorrhage
  - Hemiparesis
  - Hemisensory loss
  - Transient homonymous hemianopsia
  - Pupils may be miotic and unreactive along with a gaze palsy
  - Aphasia
  - Drowsiness, acute confusion and/or neuropsychiatric symptoms.

- Pontine haemorrhage
  - Deep coma
  - Bilateral paralysis
  - Pinpoint pupils
  - Horizontal eye movements are often absent
  - Facial palsy
  - Deafness
  - Dysarthria

- Seizures 15%
  - More common with lobar haemorrhage than deep or cerebellar